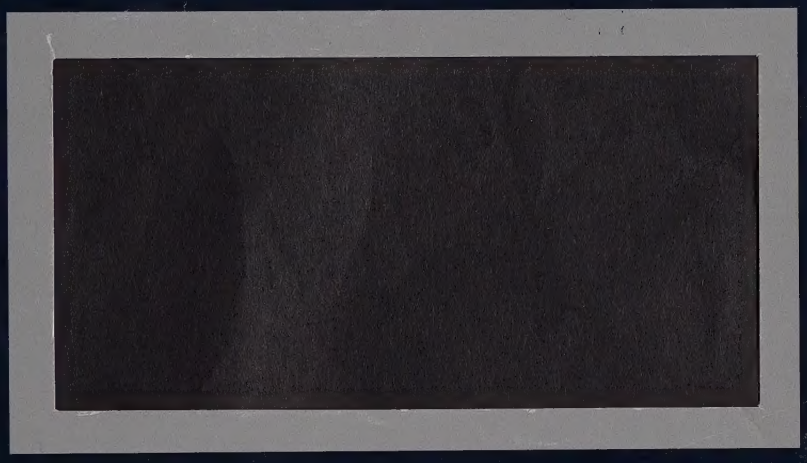
FIREBERD®



Operating Manual

TTC™
A Dynatech Company

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T1/FT1 DATA INTERFACE (MODEL 41440A) OPERATING MANUAL

June 1995

This Interface Manual applies to all FIREBERD 4000 Communications Analyzers Incorporating Software Revision 6.0, or higher and to all FIREBERD 6000 Communications Analyzers Incorporating Sofware Revision J or higher.

Rev. G

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SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains descriptions, set-up and operating instructions, specifications, maintenance, and service information on the Telecommunications Techniques Corporation (TTC) Model 41440A T1/FT1 Interface Module.

1.2 INTERFACE FEATURES

The T1/FT1 Interface Module can do all of the following:

- Test Nx64 kb/s and Nx56 kb/s contiguous or noncontiguous fractional T1 or full T1 circuits.
- Verify and troubleshoot Fractional T1 configurations.
- T1/FT1 drop and insert capability that allows Nx56 kb/s or Nx64 kb/s bit error analysis without disrupting traffic on the remaining timeslots.
- V.54 support for sending in-band loopbacks over a FT1 bandwidth.
- ANSI T1.403 PRM support for reporting on far-end status (FIREBERD 6000 only). Requires Option 6009.
- Auto-scan and auto-configure to any Fractional T1 circuit.
- T1 level and simplex current measurement.
- Timing and pattern slips analysis.
- CSU and smartjack (facility) loopback tests using built-in in-band or out-of-band ESF Data Link loop codes.
- Responds to CSU loop up and loop down codes.
- Transmits and monitors voice and ABCD signaling bits.
- Generates logic, Bipolar Violations (BPVs), and frame errors.
- Detects the presence of B8ZS, framed patterns, Yellow Alarm, Excess Zeros Alarm, AIS and ones density violation alarm conditions.
- Monitors T1 signals using BPVs, frame errors, and CRC errors.
- Measures and generates jitter with FIREBERD 6000.

1.3 INTERFACE COMPATIBILITY

The T1/FT1 Interface Module is designed in compliance with the following publications and specifications.

Bell Publication CB113 - Low Power T1 Line Repeater Compatibility Specification.

Bell Publication CB119 - Interconnection Specification for Digital Cross-Connects.

Bell Publication CB143 - Digital Access and Cross-Connect System Technical Reference and Compatibility Specification.

AT&T Publication TR41451 - High Capacity Terrestrial Digital Service.

AT&T Publication TR62411 - ACCUNET® T1.5 Service Description and Interface Specifications.

AT&T Publication TR54016 - Requirements for Interfacing Digital Terminal Equipment to Services Employing the Extended Superframe Format.

AT&T Publication TR54019A - Addendum to supplement 54019 (International ACCUNET® Digital Service Description and Interface Specifications).

Bell System T1 (DS1) 1.544 Mb/s Digital Channel Service Specifications.

ANSI Specification T1.403.

CCITT 1.544 Mb/s Recommendations.

Applicable sections of G.703 and G.704.

1.4 OPTIONS AND ACCESSORIES

The following cables are available from TTC for the T1/FT1 Data Interface:

- Model 10559, 10' cable with WECO plug to bantam plug.
- Model 10599, 4' cable with WECO plug to bantam plug.
- Model 10615, 10' cable with bantam plug to bantam plug.
- Model 10648, 7' cable with bantam plug to alligator clips.
- Model 30503, 10' cable with bantam plug (dual) to 15-pin D male connector.
- Model 30904, 16' cable with RJ-45 to RS-232.
- Model 40601, 10' cable with bantam plug (dual) to RJ-48C.
- Model 40602, 10' cable with bantam plug (dual) to RJ-45S.
- Model 11255, Replacement telephone handset (12' cord).

SECTION 2
INTERFACE DESCRIPTION

2.1 INTRODUCTION

This section contains a physical and functional description of each of the T1/FT1 Interface Module capabilities and features.

2.2 PHYSICAL DESCRIPTION

The T1/FT1 Interface Module contains an RJ-45 jack connector, a dual bantam connector, a bantam connector, and an RJ-8 jack connector (see Figure 2-1).

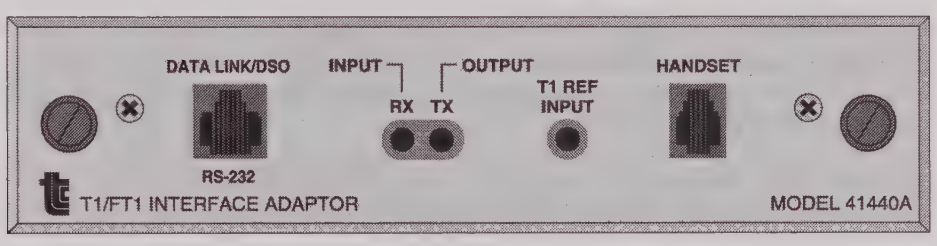

Figure 2-1
The T1/FT1 Interface Module

2.2.1 Data Link/DS0 RS-232

The DATA LINK/DS0 RS-232 is an RJ-45 jack connector. Use this connector to access the ESF data link at 4 kb/s or configure it to receive and transmit data on 1 of the 24 DS0s at 64 kb/s. See Table 2-1 for pin assignments and Figure 2-2 for pin locations.

NOTE: An RJ-45 to RS-232 25-pin D-type cable is provided with this interface.

Table 2-1
DATA LINK/DS0 RS-232 Pin Assignments

Pin:	DB-25:	EIA:	CCITT:	Function:
1	2	BA	103	Transmitted Data
2	3	BB	104	Received Data
3	4	CA	105	Request To Send
4	5	CB	106	Clear To Send
5	7	AB	102	Signal Ground
6	8	CF	109	Received Line Signal Detector
7	24	DA	113	Transmit Signal Element Timing (DTE Source)
8	17	DD	115	Receiver Signal Element Timing

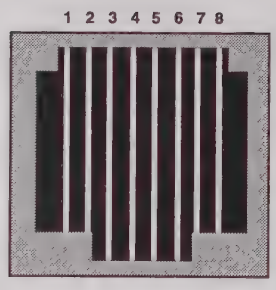

Figure 2-2
DATA LINK/DS0 RS-232 Connector

2.2.2 RX INPUT/TX OUTPUT

The connector labeled RX INPUT and TX OUTPUT is a dual bantam connector.

TX OUTPUT is a bantam connector that provides a transmit output from the FIREBERD to the circuit being tested. A cable loss of either 0 dB, -7.5 dB, or -15 dB is applied to the transmitted signal. The Line Build Out (LBO) selection in the CONFIG menu allows the user to select the amount of cable loss.

RX INPUT is a bantam connector that provides the input signal to the FIREBERD receiver circuitry. The INPUT selection in the CONFIG menu allows the user to select the input impedance applied to the receive input. The input impedance may be either TERM, BRIDGE, or DSXMON.

2.2.3 T1 Ref Input

The T1 REF INPUT connector is a bantam jack that provides an input for a T1 reference source. This connector is used in measuring timing slips and wander. The REF T1 selection in the CONFIG menu allows the user to select the termination of this input to either TERM (100 ohms) or BRDG (greater than 1000 ohms).

2.2.4 Handset

The HANDSET connector is an RJ-8 jack that connects a standard telephone handset to the FIREBERD. Use the handset to transmit and receive voice signals over a T1. See Table 2-2 for pin assignments and Figure 2-3 for pin locations.

Table 2-2
HANDSET Pin Assignments

Pin:	Function:
1	Microphone -
2	Speaker -
3	Speaker +
4	Microphone +

Figure 2-3
HANDSET Pin Locations

2.3 FUNCTIONAL DESCRIPTION

The T1/FT1 Interface Module provides the FIREBERD Communications Analyzer with the ability to test in any of the following modes of operation: Full T1, Fractional T1, Fractional T1 Drop and Insert, Voice, Test Loopback (TLB), Line Loopback (LLB), ESF Data Link, T1.403 (FIREBERD 6000 only), and RS-232. Depending on the selected mode of operation, certain other menu choices may or may not be available. Table 2-3 indicates the MODE selections and the menu choices available when in that operating mode. The following information provides a functional description of each MODE of operation.

Table 2-3
MODE Matrix

	FULL T1	FRAC T1	VOICE	TLB	LLB	RS232	ESFDL	RCV BYTE	ERR INS FRAME	T1* 403	FT1 INS
OFF (FRAME)	X	—	—	X	X	—	—	—	—	-	-
ESF (FRAME)	X	X	X	X	X	X	X	X	X	X	X
D4 (FRAME) X		X	X	X	X	X	X	—	X	X	-
SLC (FRAME)	X	X	X	X	X	X	—	X	X	-	X
IDLE	—	X	X	—	—	X	X	X	N/A	X	X
LOOP	X	X	X	N/A	N/A	X	X	N/A	N/A	X	X
PRGM	X	X	X	N/A	N/A	X	X	N/A	N/A	X	X
ABCD	—	—	X	—	—	—	—	N/A	N/A	-	-
ERR INS	X	X	—	X	—	—	X	N/A	N/A	X	X

X = Selectable — = Not Selectable N/A = Not Applicable
*FIREBERD 6000 only

2.3.1 Full T1

In Full T1 mode, the T1/FT1 Interface Module enables the FIREBERD to access and test the full bandwidth of a T1 signal (1.536 Mb/s in framed operation or 1.544 Mb/s in unframed operation).

2.3.2 Fractional T1

In Fractional T1 mode, the FIREBERD can perform Fractional T1 bit error analysis at any Nx64 kb/s and Nx56 kb/s (N = 1...24) data rate on any selected contiguous or non-contiguous channels. The channels not selected for analysis are filled with user-selectable idle code. In Nx56 kb/s operation, bit 8 (LSB) of each channel is set to a 1 on the transmit side to signify data and is ignored on the receive side. This is in compliance with the AT&T PUB 62411.

2.3.3 T1/FT1 Drop and Insert

In T1/FT1 Drop and Insert mode, the FIREBERD can perform Nx56 kb/s or Nx64 kb/s bit error analysis without disrupting traffic on remaining timeslots.

2.3.4 ANSI T1.403 PRM

In ANSI T1.403 PRM mode, the FIREBERD 6000 supports the ESF data link far-end Performance Report Message (PRM), as defined in the ANSI T1.403 (1989) standard. In this mode, the FIREBERD 6000 can report on far-end status, and can collect data such as CRC error seconds, frame error seconds, severely frame errored seconds, BPVs, controlled slips, and the originator of the PRM.

Please note that this mode is available in the FIREBERD 6000 only and requires Option 6009 to be installed.

2.3.5 Voice

In Voice mode, the T1/FT1 Interface Module can be used to insert and monitor voice data and to monitor and transmit ABCD signaling bits. When the FIREBERD is monitoring ABCD signaling bits it extracts the ABCD signaling bits from a single DS0 in the incoming data. The ABCD bits are displayed as the Rx ABCD result.

2.3.6 Test Loopback TLB

In Test Loopback (TLB) mode, the T1/FT1 Interface Module emulates a CSU or a channel bank in digital loopback. All received data is echoed on the transmitter output and the received signal is analyzed by the FIREBERD data receiver. ERRINS, CODE, and jitter generation (if FIREBERD Option 6003 is installed) remain active. BPVs and B8ZS coding are stripped from the received signal. The outgoing signal is re-timed and re-encoded using AMI or B8ZS according to the CODE menu selection. BPV, logic, and logic & BPV can be inserted depending on the ERRINS menu selection.

2.3.7 Line Loopback LLB

In Line Loopback (LLB) mode, the T1/FT1 Interface Module acts as a repeater. All data received is echoed unchanged on the transmitter output. LLB MODE may be used to emulate a Channel Service Unit (CSU) in line loopback mode. The received signal is analyzed by the FIREBERD data receiver.

NOTE: If LLB is selected, logic errors or BPVs cannot be inserted and the signal cannot be re-encoded. The ERRINS and CODE menus are displayed after the `Unavailable in this mode` warning message is displayed.

2.3.8 ESF Data Link

In ESFDL mode (ESF Data Link) the FIREBERD pattern generator is used to transmit a test pattern over the ESF Data Link. In this mode, all payload channels are filled with the user-programmable idle code. The received ESF Data Link is sent to the FIREBERD pattern generator receiver for bit error analysis.

2.3.9 RS232

In RS232 mode, the RJ-45 jack on the T1/FT1 Interface Module is able to drop and transmit 64 kb/s data on a single DS0 of the T1 circuit. The T1/FT1 Interface Module acts as a synchronous DCE by providing a receive clock to the DTE. The transmit and receive channels are user selectable.

In RS232 DATLNK mode, the RJ-45 jack on the T1/FT1 Interface Module can drop and insert a 4 kb/s signal on the ESF Data Link. The 4 kb/s signal is generated by an external device and received by the FIREBERD through the RJ-45 jack. It is then inserted into the generated T1 signal as the ESF Data Link. This T1 signal is transmitted through the TX OUTPUT connector. The received T1 (RX INPUT) is demultiplexed to obtain the ESF Data Link, which is then transmitted from the RJ-45 jack to an external device as a synchronous 4 kb/s signal.

2.4 SELF-LOOP OPERATION

The T1/FT1 Interface Module includes a relay that is activated by pressing the **SELF LOOP** switch on the FIREBERD front panel. Pressing the **SELF LOOP** switch connects the primary T1 driver to the line receiver. This provides quick verification of the FIREBERD and the T1/FT1 Interface Module when performing bit error detection. The input and primary output connections do not need to be removed during the test, since complete isolation is provided by the relay.

NOTE: Do not set the generator clock, GEN CLK pushbutton on the FIREBERD 6000, or the GENERATOR CLOCK SETUP CATEGORY on the FIREBERD 4000 to the INTF position during the self-loop mode. The THRU interface menu should be set to OFF.

SECTION 3
FIREBERD 6000
INSTALLATION AND OPERATION

3.1 INTRODUCTION

This section describes how to install, configure, and operate the T1/FT1 Interface Module with a FIREBERD 6000. Refer to the *FIREBERD 6000 User's Guide* or the *FIREBERD 6000 Reference Manual* for mainframe operating procedures.

NOTE: Configure the FIREBERD 6000 and the T1/FT1 Interface Module before connecting the FIREBERD to the circuit under test. This avoids unnecessary circuit downtime.

3.2 INSTALLING THE INTERFACE

The following procedure describes how to install the T1/FT1 Interface into the FIREBERD 6000. Figure 3-1 illustrates how the interface is installed into a FIREBERD 6000 mainframe.

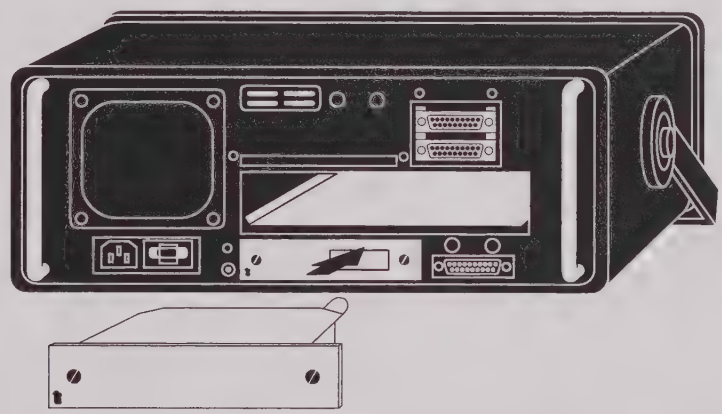

Figure 3-1
FIREBERD 6000 Interface Installation

CAUTION:

BEFORE INSTALLING OR REMOVING THE INTERFACE MODULE, TURN THE FIREBERD MAINFRAME AC POWER OFF.

1. Turn the AC power to the FIREBERD OFF.
2. Face the FIREBERD rear panel. Insert the interface in the interface slot with the face plate facing out. Make sure the interface PC board edges are fitted into the card guides in the mainframe.
3. Slide the interface module into the FIREBERD until the back of the interface panel is flush with the rear panel.
4. Secure the interface module in the mainframe by rotating the thumbscrews on the interface panel clockwise, until finger tight.
5. Turn the FIREBERD mainframe AC power ON and configure the FIREBERD and interface as described in the following sections.

3.3 FIREBERD 6000 MAINFRAME SET-UP

Perform this procedure to configure the FIREBERD 6000 with the T1/FT1 Interface Module.

1. Turn the AC power ON. If necessary, press the **SELF LOOP** switch to extinguish its LED before starting.

2. Connect the T1 signal source to the interface bantam connector marked RX INPUT and the T1 output to the bantam connector marked TX OUTPUT (as applicable).

3. If timing slip measurements are to be performed, connect the T1 reference signal source to the bantam connector marked T1 REF.

4. Press the **DATA** switch to select the desired test pattern. Refer to the *FIREBERD 6000 Reference Manual* for descriptions of the test patterns.

5. Press the **GEN CLK** switch to select the signal timing source. To select a signal timing source other than SYNTH requires an external clock source from either the network or from another source.

6. The **TIMING MODE** switch selection is not necessary for this interface.

7. Press the **MENU** switch to illuminate the LED next to the INTF SETUP label.

8. Press the T1/FT1 softkey to select the T1/FT1 Interface Module. Configure the interface for operation.

9. Use the **MENU** switch to select other criteria for the test to be performed.

10. Set the ANALYSIS RESULT, ANALYSIS MODE, and PRINTER as required.

3.4 FIREBERD 6000 INTERFACE MENU

The following information describes how to access the interface menu and discusses each of the selections in the T1/FT1 Interface menu.

3.4.1 FIREBERD 6000 Interface Menu Control

The T1/FT1 Interface menu is selected through the mainframe INTF SETUP menu. Press the T1/FT1 softkey to access the T1/FT1 Interface menu. Press the corresponding softkey to select a function or another menu. To return to the previous menu display, press the mainframe keypad "up arrow." To return to the main interface menu, press the mainframe **ENTER** key. Some menus require additional information to be keyed in through the mainframe keypad. When the new information is correct, press the **ENTER** key to enter the information into memory. Pressing a softkey in any menu either (1) scrolls a list of parameters that are automatically acted upon (2) executes a function, or (3) provides assistance. All interface menu settings are retained when mainframe power is turned off.

The T1/FT1 main menu has six selections that are used to configure and control the interface operation and network under test (see Figure 3-2). The CONFIG menu is used to configure the interface. The MODE menu selects the interface mode of operation. The ERRINS menu is used to insert errors into the data stream. The IDLE menu selects the idle code. The LOOP menu determines the type of loop code for loopback tests. The RCVBYT menu selects the channel number for the received byte (RCV BYTE) result.

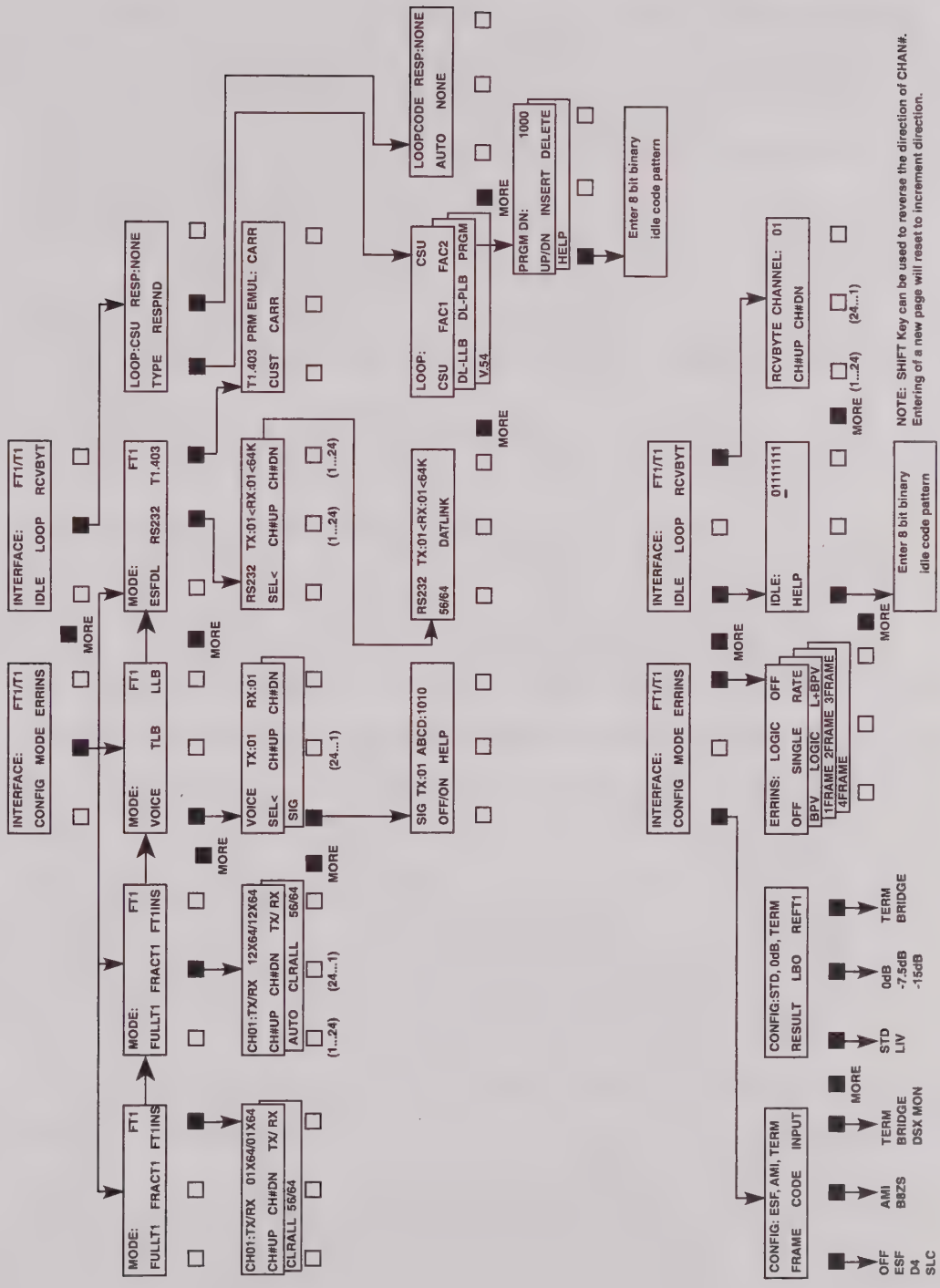

Figure 3-2
FIREBERD 6000 Menu Tree

3.4.2 Configuration Menu

CONFIG - The configuration menu allows the user to configure the framing, coding, input termination, line build out, and the T1 reference input termination.

FRAME - Select the framed data format for transmission and analysis.

OFF - Selects unframed data format and performs data analysis on the full 1.544 Mb/s bandwidth of the T1 line. No framing bits are added during transmission and no data bits are stripped during reception. Note that when FRAME is set to OFF, the only MODE menu selections are: FULL T1, TLB, or LLB.

ESF - Allows the FIREBERD to transmit and analyze T1 signals with Extended SuperFrame (ESF) framing format. With ESF framed signals, the framing pattern occupies 2 kb/s, the CRC occupies 2 kb/s, the data link occupies 4 kb/s, and the selected data pattern occupies the remaining 1.536 Mb/s.

D4 - Allows the FIREBERD to transmit and analyze T1 signals with D4 (Superframe) framing. D4 framing occupies 8 kb/s of the 1.544 Mb/s bandwidth and the selected data pattern occupies the remaining 1.536 Mb/s. The D4 framing format is compatible with D1D, D2, D3, and D4 channel banks.

SLC - Allows transmission and analysis of a T1 signal with SLC-96 framing. SLC-96 framing and the control channel occupy 8 kb/s of the 1.544 Mb/s bandwidth, with the selected data pattern occupying the remaining 1.536 Mb/s.

NOTE: With the ESF, D4, or SLC framing selected, the receiver frequency measurements are available only when the data interface is in continuous frame synchronization with the incoming data. If there is intermittent frame synchronization or no frame synchronization at all (i.e., unframed data), receiver frequency measurements may be obtained by setting the FRAME menu to OFF.

CODE - Determines whether the FIREBERD transmits with AMI-encoded data or B8ZS clear-channel encoding.

AMI - Allows Alternate Mark Inversion (AMI) coding. AMI is encoded by transmitting a pulse of alternating polarity for each "one" (MARK) and no pulse for each "zero" (SPACE). The pulse is active for the first half of the bit time period.

B8ZS - Selects Bipolar with 8 Zero Substitution (B8ZS) coding for the transmitted signal. B8ZS transmits a pulse of alternating polarity for each one and no pulse for each zero, except for strings containing 8 consecutive zeros, which are replaced by a zero substitution code. This causes a series of 8 zeros to be replaced by 000V10V1, where 0 represents a SPACE, 1 represents a MARK, and V represents a bipolar violation. Bipolar violations always occur at the 4th and 7th bit positions of the substituted word. The B8ZS decoder restores a detected B8ZS pattern to the original 8 zeros.

INPUT - Allows selection of input impedance and signal conditioning.

TERM - Selects normal operation, terminating the input with 100 ohms and accepting a T1 signal attenuated between +6 dB and -35 dB due to cable loss.

BRIDGE - Allows monitoring of T1 lines that are already terminated. In BRIDGE mode, the input exhibits an impedance greater than 1000 ohms. Signals are accepted that have been attenuated between +6 dB and -35 dB due to cable loss.

DSXMON - Conditions the receiver to operate with signals from DSX-Monitor ports. In this mode, the input accepts T1 signals that have been resistively attenuated between 10 dB and 30 dB, and terminates the line with 100 ohms.

RESULT - Allows selection of the results analysis. Analysis result selections are standard (STD) or live (LIV).

STD - Selects standard analysis results. The FIREBERD generates the selected DATA pattern. Bit error, BPV, framing error, and Cyclic Redundancy Check (CRC) error analysis are performed during the time interval that bit error analysis is performed. CRC error analysis is only performed when this selection is combined with the selection of ESF from the FRAME menu. With STD selected, loop-up and loop-down codes can be sent by pressing the corresponding FIREBERD front panel pushbutton.

LIV - Selects live traffic analysis results. Bit error analysis is not performed, but BPV, framing error, and CRC error analysis are performed during the time that the signal is present. CRC error analysis is only performed when this selection is combined with the selection of ESF from the FRAME menu.

NOTE: When LIV is selected and the SYNC LED is illuminated, it indicates signal presence instead of synchronization. LIV is automatically selected when VOICE or RS232 is selected for the MODE menu, regardless of the selected RESULTS.

LBO - Allows emulation of three different cable losses for the T1 output signal level (0 dB, -7.5 dB, -15 dB). The selected cable loss affects the transmit data only at the connectors.

0dB - Sets the primary output (TX) to the DSX level with no line build-out (0 dB attenuation).

-7.5dB - Provides a -7.5 dB line build-out, attenuating the output with 7.5 dB of simulated cable loss.

-15dB - Provides a -15 dB line build-out, attenuating the output with 15 dB of simulated cable loss.

NOTE: When changing the line build out level, an errored second or loss of synchronization may occur.

REF T1 - Allows selection of the input impedance and signal conditioning for the T1 reference signal.

TERM - Selects normal operation, terminating the T1 reference input with 100 ohms and accepting a relatively unattenuated (+6 through -6 dB) T1 reference.

BRDG - Allows monitoring of reference T1 lines that are already terminated. In this mode, the input exhibits an impedance greater than 1000 ohms. Use BRDG at monitoring points.

3.4.3 Mode Menu

MODE - The mode menu allows the user to select the interface transmit and receive operating mode.

FULLT1 - Configures the FIREBERD to transmit and receive data at the full T1 rate. The data transmitted is framed or unframed depending on the FRAME selection in the CONFIG menu. Note that when FRAME is set to OFF, FULLT1 is the only MODE selection available.

FRACT1 - Allows data to be transmitted and received at any fractional T1 rate of Nx64 kb/s or Nx56 kb/s (N = 1 to 24) on any selection of contiguous or non-contiguous time slots.

CHAN UP - Selects the channel numbers that are to be isolated and tested on the respective transmit or receive channel. Pressing the CHAN UP softkey scrolls through the channel numbers (1 to 24). The channel numbers may be selected contiguously or non-contiguously.

CHAN DN - Selects the channel numbers that are to be isolated and tested on the respective transmit or receive channel. Pressing the CHAN DN softkey scrolls through the channel numbers (24 to 1). The channel numbers may be selected contiguously or non-contiguously.

TX/RX - Allows the user to select whether the selected channel(s) will be active or inactive on the Fractional T1 signal generated by the FIREBERD. A transmit channel is identified as ON when TX is displayed next to the selected channel. A receive channel is identified as ON when RX is displayed next to the selected channel. A channel is identified as OFF when "- -" is displayed next to the selected channel. Repeatedly pressing the TX/RX softkey toggles the channel through the four choices:

```
TX/RX
TX/- -
- -/RX
- -/- -
```

When TX/RX is selected for the displayed channel, both values on the top line increment by one. For example, if channel 1 is set to transmit and receive and all the other channels are turned off, the top line displays: `CH01: TX/RX 01X64/01X64`. The left value (01 to 24) indicates the number of active transmit channels and the right value (01 to 24) indicates the number of active receive channels.

AUTO - Activates auto-configuration. Auto-configuration scans all receive channels looking for the idle code (set by the IDLE menu). Channels that do not match the idle code are assumed to be active and the transmit channel is set ON. `Scanning...` is visible in the display while the channels are being scanned.

CLRALL - Clears all of the currently selected channels.

56/64 - Selects the channel bandwidth for either Nx56 kb/s or Nx64 kb/s data analysis. Note that the T1-mW pattern is only for 1 x 64 kb/s bandwidth use.

FT1INS - Selects the FT1 insert operating mode, which allows the insertion a BERT pattern on any combination of selected Nx64 kb/s or Nx56 kb/s timeslots without disrupting traffic on the remaining timeslots. *FT1INS differs from FRACT1 operation in that unused timeslots at the FIREBERD's output contain data received in that timeslot.* Refer to the FRACT1 menu for a description of FT1INS items.

In FT1INS mode, the unused timeslots are filled with received data (in lieu of the eight-bit idle code). Please note that the AUTO selection is disabled in this mode.

VOICE - Select this menu when monitoring voice channels, when monitoring ABCD signaling bits, or when transmitting voice or ABCD signaling bits.

SEL< - Selects the transmit or receive voice and ABCD signaling channel. Signaling choices are:

```
TX:01<RX:01<
TX:01 RX:01<
TX:01<RX:01
```

CHAN UP - Selects the voice and ABCD signaling channel 01 to 24.

CHAN DN - Selects the voice and ABCD signaling channel 24 to 01.

SIG - Allows the user to set the ABCD robbed bit signaling on the selected transmit channel.

OFF/ON - Enables (ON) or disables (OFF) the ABCD robbed bit signaling. When ON is selected, the signaling bit values are visible on the top line. The cursor flashes under the first digit.

Use the 0 and 1 keys to program or edit the logic state of the ABCD signaling bits of the selected transmit channel (TX). The left and right cursor keys are used to position the cursor under the signaling bits. The 1 and 0 keys are used to set the value of the ABCD signaling bits. Pressing the **ENTER** key saves and implements the signaling bit changes.

The signaling bits transmitted are determined by the FRAME selection in the CONFIG menu. The following describes the signaling bits associated with each FRAME selection:

- ESF - A, B, C, and D
- D4 - A and B
- SLC - A and B
- OFF - None

HELP - Displays the message: `Enter ABCD signaling in binary format` momentarily. Use the0 or 1 key to set the binary value at the cursor position.

TLB - Selects Test Loopback (TLB). This selection emulates a CSU or a channel bank in digital loopback. All received data is echoed on the transmitter output and the received signal is analyzed by the FIREBERD data receiver. ERRINS, CODE, and jitter generation (if FIREBERD Option 6003 is installed) remain active. BPVs and B8ZS coding are stripped from the received signal. The outgoing signal is re-timed and re-encoded with AMI or B8ZS according to the CODE menu selection. BPV, logic, or logic & BPV can be inserted depending on the ERRINS menu selection. The data can be jittered if the Jitter Generation Option 6003 is installed and selected.

LLB - Selects Line Loopback (LLB). This selection causes the interface to act as a repeater. All data received is echoed unchanged on the transmitter output. This selection may be used to emulate a CSU in line loopback mode. The received signal is analyzed by the FIREBERD data receiver. Note that if LLB is selected, logic errors or BPVs cannot be inserted and the signal cannot be re-encoded. The ERRINS and CODE menus are still displayed after an appropriate warning message.

ESFDL - Configures the FIREBERD to receive and transmit data patterns on the 4 kb/s ESF data link. The 24 time slots of the transmit signal are filled with the selected idle code. If the FRAME menu is not set to ESF, the message `CONTENTION ON ESF FRAME` flashes in the RESULTS window.

RS232 - Configures the RS-232 port to transmit and receive.

SEL< - Sets the selected channel on the RS-232 port to transmit and/or receive synchronous data using an external device. Select choices are:

```
TX:01<RX:01<
TX:01 RX:01<
TX:01<RX:01
```

CH UP - Selects the channels (01 to 24) on the RS-232 port to receive and/or transmit synchronous data using an external device.

CH DN - Selects the channels (24 to 01) on the RS-232 port to receive and/or transmit synchronous data using an external device.

56/64 - Selects the synchronous data rate for the selected channel.

DATLNK - Configures the RS-232 port to drop the 4 kb/s ESF Data Link to an external device and to insert 4 kb/s synchronous data from an external device onto the ESF data link.

T1.403 - Configures the FIREBERD to report on far-end status by collecting a variety of PRM-specific measurements. In T1.403 mode, PRMs are generated at the rate of one per second.

CUST - Selects emulation of the customer PRM. When specified, the PRM C/R bit is set to zero (0).

CARR - Selects emulation of the carrier PRM. When specified, the PRM C/R bit is set to one (1).

3.4.4 Error Insert Menu

ERRINS - The ERROR INSERT menu allows BPV, logic, or frame errors to be inserted singly or at a selected rate.

NOTE: This menu is not available if the LLB MODE is selected.

OFF - The error insert capability is disabled.

SINGLE - Causes a single error to be inserted into the data stream. The error inserted is either a BPV, logic, or logic & BPV depending on the selected error type.

RATE - Allows the user to select the BPV and LOGIC error insertion rate. The error insertion rate can be programmed between 1E-9 to 9E-3 by using the keypad keys and the cursor position keys.

Select the error insertion rate using the menu keypad. Position the cursor with the left and right cursor keys. Use the keypad keys 1-9 to enter a new error insertion rate. Press the **ENTER** key to save and implement all changes made to the error insertion rate. Entering an out-of-tolerance value produces an audio tone and redisplays the last valid insertion rate. Set the synthesizer to 1544 kHz regardless of the GEN CLK selection.

HELP - Displays the message: `Enter error insertion rate: 1E-9 to 9E-3` momentarily.

BPV - Causes bipolar violation (coding) errors to be inserted at the specified RATE.

LOGIC - Causes logic errors to be inserted at the specified RATE. The logic error may fall on any bit either data or framing within the entire bandwidth.

L+BPV - Causes logic and BPV errors to be inserted simultaneously at the specified RATE. This type of error typically occurs on a repeatered line due to the addition or deletion of a pulse.

1FRAME - Inserts a single frame error into the framing pattern each time the softkey is pressed.

2FRAME - Inserts two consecutive frame errors into the framing pattern each time the softkey is pressed.

3FRAME - Inserts three consecutive frame errors into the framing pattern each time the softkey is pressed.

4FRAME - Inserts four consecutive frame errors into the framing pattern each time the softkey is pressed.

NOTE: The softkeys 1FRAME, 2FRAME, 3FRAME, and 4FRAME are available when in any framing mode. Pressing any of these softkeys sets RATE to OFF. The FRAME errors are inserted on the F_t bits (D4/SLC-96) or the FPS bit (ESF).

3.4.5 Idle Selection Menu

IDLE - The idle selection menu allows the user to program the 8-bit idle code. This menu also allows you to identify which channels of the received input signal contain the specified idle code.

Program the idle code using the 0 and 1 keys. Position the cursor with the left and right cursor keys. Use the 1 and 0 keys to enter an idle code. Press the **ENTER** key to save and implement idle code changes.

3.4.6 Loop Type Menu

LOOP - Selects the loop code sequence transmitted through the active DS0 channels or through the ESF Data Link when the **LOOP UP** and **LOOP DOWN** switches are pressed.

TYPE - Pressing the TYPE softkey displays the first three loop code types. Pressing the **MORE** key displays the remaining three loop code types. Loop code types are:

CSU - Channel Service Unit. Selects repeating in-band CSU loop codes; loop up: 10000 and loop down: 100.

FAC1 - Facility Type 1. Selects network interface (or smart jack) loop codes to be transmitted by the FIREBERD. In-band repeating 4-bit loop codes: loop up 1100 and loop down 1110.

FAC2 - Facility Type 2. Selects network interface (or smart jack) loop codes to be transmitted by the FIREBERD. In-band repeating 5-bit loop codes: loop up 11000 and loop down 11100.

DL-LLB - Out-of-band Data Link Line Loopback loop codes are transmitted and recognized by the FIREBERD on the ESF data link. This code is transmitted to the far end equipment to place the far end equipment into a line loopback. ESF out-of-band CSU loop codes: loop up 1111 1111 0111 0000 and loop down 1111 1111 0001 1100. The left-most bit is transmitted first.

DL-PLB - Out-of-band Data Link Payload Loopback loop codes are transmitted and recognized by the FIREBERD on the ESF data link. This code is transmitted to the far end equipment to place the far end equipment into a payload loopback. The CSU loops back the payload data, reframes the signal, and recalculates the CRCs. DL-PLB loop codes: loop up 1111 1111 0010 1000 and loop down 1111 1111 0100 1100. The left-most bit is transmitted first.

PRGM - Programmable in-band loop codes are transmitted by the FIREBERD. The programmable loop codes can be 3- to 8-bits in length.

Program the loop code using the menu keypad. Position the cursor with the left and right cursor keys. Use the1 and 0 keys to enter a loop code. Press the **ENTER** key to save and implement all changes made to the loop code. Up to eight bits of the loop code may be programmed.

UP/DN - Selects whether the programmed loop code is either a loop up or loop down code.

INSERT - a bit in the loop code.

DELETE - Remove a bit from the loop code.

HELP - Displays the message: **`Enter 3 to 8 bit binary loop code`** momentarily.

V54 - In-band loopback transmitted over a Fractional T1 channel.

RSPND - Pressing the RSPND softkey displays the response taken when the loop code is detected. Loop code responses are:

AUTO - Selects line loopback if the loopback code is received.

NONE - Ignores any loopback codes received.

3.4.7 Receive Byte Selection Menu

RCV BYTE - This menu selects which channel is displayed in the received byte result (RCV BYTE) display. This result is displayed in the SIGNAL results category.

CH# UP - Press this softkey to scroll through each channel (01 to 24) and display the byte value of the selected channel in the ANALYSIS RESULT SIGNAL CATEGORY under the RCV BYTE result.

CH# DN - Press this softkey to scroll through each channel (24 to 01) and display the byte value of the selected channel in the ANALYSIS RESULT SIGNAL CATEGORY under the RCV BYTE result.

3.5 FIREBERD 6000 ANALYSIS RESULTS

Table 3-1 lists the analysis results that are displayed when the T1/FT1 Interface Module is installed in the FIREBERD 6000. Refer to the *FIREBERD 6000 Reference Manual* for results definitions not described in this section.

Table 3-1
FIREBERD 6000 Analysis Results

Category:	Displayed Result:	Description:
ERROR	AVG BER	Average Bit Error Rate
	BER	Bit Error Rate
	BIT ERRS	Bit Errors
TIME	%PAT SEC	% Pattern Seconds
	DATE	Date
	EA SEC	Error Analysis Seconds
	EF EAS	Error-Free Error Analysis Seconds
	ELAP SEC	Elapsed Seconds
	ERR EAS	Errored Error Analysis Seconds
	PATL SEC	Pattern Seconds
	TIME	Time
T-CARRIER	%VF EAS	% Violation-Free Error Analysis Seconds
	AVG BPVR	Average Bipolar Violation Rate
	AVG CRC	Average CRC Error Rate
	AVG FER	Average Frame Error Rate
	BIT SLIP	Bit Slips
	BPVs	Bipolar Violations
	BPV Rate	Bipolar Violation Rate
	CRC ERR	CRC Errors
	CRC E Rt	CRC Error Rate
	FE Rate	Frame Error Rate
	FRA ERR	Frame Errors
	FRA LOSS	Frame Loss
	MAX ZERO	Maximum Zeros
	RCV BOM	Receive Bit Oriented Message
	Rx ABCD	Receive ABCD
	VF EAS	Violation-Free Error Analysis Seconds
	F FR ES	Far-End Frame Error Seconds
	F F SES	Far-End Severely Errored Framing Seconds
	F BPV S	Far-End BPV Seconds
	F SLP S	Far-End Controlled Slip Seconds
	PRM TIM	Far-End Performance Report Seconds
	F CRC E	Far-End CRC Error Events
	F SI CRC	Far-End CRC 1 Bin
	F LO CRC	Far-End CRC 2 to 5 Bin
	F MD CRC	Far-End CRC 6 to 10 Bin
	F MH CRC	Far-End CRC 11 to 100 Bin
	F HI CRC	Far-End CRC 101 to 319 Bin
	F SV CRC	Far-End CRC 320 to 333 Bin
	F HS CRC	Far-End Severely High CRC Bin
	PAY SRC	Far-End Payload Source/Loopback

Table 3-1
FIREBERD 6000 Analysis Results (Continued)

Category:	Displayed Result:	Description:
SIGNAL	% MASK	Maximum % of Mask
	+LVL V	Positive Receive Level (in V)
	-LVL V	Negative Receive Level (in V)
	+LVL dB	Positive Receive Level (in dB)
	-LVL dB	Negative Receive Level (in dB)
	+WNDR	Positive Peak Wander
	-WNDR	Negative Peak Wander
	1SEC JTR	One Second Jitter
	15m WNDR	Peak-to-Peak Wander 15 Minutes
	24h WNDR	Peak-to-Peak Wander 24 Hours
	B8ZS DETECTED	B8ZS Detected
	DELAY	Delay
	GEN FREQ	Generator Clock Frequency
	JTR HITS	Jitter Hits
	LVL dBm	Receive Level (in dBm)
	MAX JTR	Maximum Jitter
	PP LVL V	Peak-to-Peak Receive Level (in V p-p)
	RCV BYTE	Receive Byte
	RCV COD	Receive Code
	RCV FREQ	Receive Frequency
	SMPX CUR	Simplex Current
ALARMS	1s DEN S	1's Density Violation Seconds
	AIS SEC	Alarm Indication Seconds
	PAT LOSS	Pattern Loss
	PWR LOSS	Power Loss
	SIG LOSS	Signal Loss
	XS0 SEC	Excess Zero Seconds
	YEL SEC	Yellow Alarm Seconds
PERFORMANCE	%AVL SEC	% Available Seconds
	%DEG MIN	% Degraded Minutes
	%SES	% Severely Errored Seconds
	AVL SEC	Available Seconds
	BER-SES	Bit Error Rate Less Severely Errored Seconds
	DEG MIN	Degraded Minutes
	ERR-SES	Bit Errors Less Severely Errored Seconds
	G%EFS	G.821 % Error-Free Seconds
	G EFS	G.821 Error-Free Seconds
	GERR SEC	G.821 Errored Seconds
	SES	Severely Errored Seconds
	UNA SEC	Unavailable Seconds
	G VFS	G.821 Violation Free Seconds
	%SVS	% Severely Violated Seconds
	G %VFS	G.821 % Violation Free Seconds
	SVS	Severely Violated Seconds

The results unique to the T1/FT1 Interface Module are described below.

T-CARRIER Results Category

BIT SLIP - Bit Slips
The number of bit slips that occur relative to the T1 reference signal.

MAX ZERO - Maximum Zeros
The maximum number (0 - 255) of consecutive zeros received since the last test restart. Note that when a signal loss occurs, this result is ignored until the test is restarted. Note that when a value of 255 is displayed, it actually means that the maximum number of consecutive zeros since the last test restart is *255 or greater.*

RCV BOM - Received Bit Oriented Message
Decodes and displays the ASCII message of the Bit Oriented Message on the ESF Data Link per ANSI Document T1.403. This result is only available when FRAME is set to ESF.

Possible ASCII messages:

YEL ALM - yellow alarm
LLB ACT - line loopback activated
LLB DEA - line loopback deactivated
PLB ACT - payload loopback activated
PLB DEA - payload loopback deactivated

NOTE: The remaining messages are displayed in binary.

RX ABCD - Receive ABCD
Displays the ABCD signal bits of the selected DS0 channel while in VOICE MODE.

F FR ES - Far-End Frame Error Seconds
A count of the seconds in which one or more frame errors occurred in the received signal at the far end. This result reports on the PRM Frame Synchronization Bit Error Event Bit (FE = 1) status.

F F SES - Far-End Severely Errored Framing Seconds
A count of the seconds in which two or more frame errors occurred in less than 3 ms in the received signal at the far end. This result reports on the PRM Severely Errored Framing Event Bit (SE = 1) status.

F BPV S - Far-End BPV Seconds
A count of the seconds in which one or more BPVs occurred in the received signal at the far end. This result reports on the PRM Line Code Violation Event Bit (LV = 1) status.

F SLP S - Far-End Controlled Slip Seconds
A count of the seconds in which controlled slips occurred in less than 3 ms in the received signal at the far end. This result reports on the PRM Controlled Slip Event Bit (SL = 1) status.

PRM TIM - Far-End Performance Report Seconds
A count of the seconds, since test restart, in which a valid PRM was received.

F CRC E - Far-End CRC Error Events
A count of the minimum number of Cyclic Redundancy Check (CRC) errors reported in the F XX CRC bins described immediately following (e.g., F SI CRC, F LO CRC, F MD CRC, etc.). This result reports on the PRM CRC Error Event Bits (G1 to G6) status. When the result is displayed and the indicated count is an approximation of the actual CRC error count, a "greater than" sign (>) precedes the result count.

F SI CRC - Far-End CRC 1 Bin
A count of the seconds with only one CRC error reported in the received signal at the far end. This result reports on the first PRM CRC Error Event Bit (G1 = 1).

F LO CRC - Far-End CRC 2 to 5 Bin
A count of the seconds with two to five CRC errors reported in the received signal at the far end. This result reports on the second PRM CRC Error Event Bit (G2 = 1).

F MD CRC - Far-End CRC 6 to 10 Bin
A count of the seconds with six to ten CRC errors reported in the received signal at the far end. This result reports on the third PRM CRC Error Event Bit (G3 = 1).

F MH CRC - Far-End CRC 11 to 100 Bin
A count of the seconds with 10 to 100 CRC errors reported in the received signal at the far end. This result reports on the fourth PRM CRC Error Event Bit (G4 = 1).

F HI CRC - Far-End CRC 101 to 319 Bin
A count of the seconds with 101 to 319 CRC errors reported in the received signal at the far end. This result reports on the fifth PRM CRC Error Event Bit (G5 = 1).

F SV CRC - Far-End CRC 320 to 333 Bin
A count of the seconds with 320 to 333 CRC errors reported in the received signal at the far end. This result reports on the sixth PRM CRC Error Event Bit (G6 = 1).

F HS CRC - Far-End Severely High CRC Bin
A combined count of the F HI CRC and F SV CRC, which is the number of seconds with 101 to 333 CRC errors reported in the received signal at the far end. This result reports on the fifth and sixth PRM CRC Error Event Bit (G5 or G6 = 1).

PAY SRC - Far-End Payload Source/Loopback
Identifies the direction of the PRM according to the PRM Command/Response Bit (C/R) and the Payload Loopback Activated Bit (LB). In end-to-end applications, a customer-generated PRM is indicated as CUST (C/R = 0 and LB = 0) and a carrier-generated PRM is indicated as CARR (C/R = 1 and LB = 0) in the display. In payload loopback applications, the customer-generated PRM is indicated as CUST LOOP (C/R =0 and LB =1) when the customer is looped back and the carrier-generated PRM is indicated as CARR LOOP (C/R = 1 and LB = 1) when the carrier is looped back.

SIGNAL Results Category

+LVL dB - Positive Receive Level (in dB)
The level of the received signal in dB, relative to the positive level measurement. This measurement can range between 6 dB and -39 dB. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

-LVL dB - Negative Receive Level (in dB)
The level of the received signal in dB, relative to the negative level measurement. This measurement can range between 6 dB and -39 dB. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

+LVL V - Positive Receive Level (in V)
The base-to-peak level of the received signal in V, measured on the positive T1 pulses. This measurement can range between +6.0 V and +34.0 mV. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

-LVL V - Negative Receive Level (in V)
The base-to-peak level of the received signal in V, measured on the negative T1 pulses. This measurement can range between +6.0 V and +34.0 mV. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

LVL dBm - Receive Level (in dBm)
The power level of an unframed all-ones signal (available only when AIS is detected).

PP LVL V - Peak-to-Peak Receive Level (in V p-p)
The level of the received signal in peak-to-peak volts. This measurement can range from +12.0 V to +67.0 mV. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

RCV BYTE - Receive Byte
The received data bytes displayed in binary form as follows: 12345678 Bit Number
xxxxxxxx ← Least significant bit

SMPX CUR - Simplex Current (in mA)
The value of the simplex current flowing between the transmit output tip and ring and the receive input tip and ring. Positive simplex current is taken in on the receive input and goes out the transmit output.

NOTE: Wander results are only available when a T1 Reference signal is available.

PP WNDR - Peak-to-Peak Wander
The total deviation of positive-to-negative peak wander since the beginning of the test, defined in Unit Intervals (UIs).

+WNDR - Positive Peak Wander
The maximum positive peak wander deviation since the beginning of the test, defined in UIs.

-WNDR - Negative Peak Wander
The maximum negative peak wander deviation since the beginning of the test, defined in UIs.

15m WNDR - Peak-to-Peak Wander 15 Minutes
The maximum peak-to-peak wander deviation over the last 15 minutes of the test. This result is unavailable for the first 15 minutes of the test and is updated once per minute thereafter.

24h WNDR - Peak-to-Peak Wander 24 Hours
The maximum peak-to-peak wander deviation over the last 24 hours of the test. This result is unavailable for the first 24 hours of the test and is updated once per hour thereafter.

ALARMS

1s DEN S - 1's Density Violations Seconds
The number of seconds during which less than 3 ones in 24 bits are detected.

AIS SEC - AIS (All Ones) Alarm Seconds
The number of seconds since the beginning of the test in which an unframed all ones alarm was detected.

YEL SEC - Yellow Alarm Seconds
The number of seconds since the beginning of the test in which a yellow alarm was active.

XS0 SEC - Excess Zero Seconds
The number of seconds during which 16 or more consecutive zeros are detected.

3.6 INTERFACE STATUS INDICATORS AND SWITCHES

When the T1/FT1 Interface Module is used, the mainframe identifies the interface status indicators and switches as follows: FRM SYNC, CODE, ALM 1, ALM 2, LOOP UP, and LOOP DOWN.

The FRM SYNC LED illuminates when the interface is configured to receive a signal with ESF, D4, or SLC framing at any rate and the interface has synchronized on the appropriate framing pattern. The CODE LED illuminates when the interface receives a B8ZS-encoded T1 signal. The ALM 1 LED illuminates when a yellow alarm is detected. The ALM 2 LED illuminates when an excess zeros alarm is detected.

When the **LOOP UP** switch is pressed and released, the selected loopback sequence is transmitted to the appropriate terminal. The switch is illuminated while the loopback is being established. Pressing and releasing the **LOOP DOWN** switch transmits the appropriate loop down code. The switch is illuminated while the loop down code is being transmitted. When the loop codes are being sent, status messages appear in the Results Analysis display.

3.7 FIREBERD 6000 PRINTER OPERATION

Refer to the *FIREBERD 6000 Reference Manual* for printer set-up and operating instructions. Figure 3-3 is a typical T1/FT1 Interface Controls printout. Figure 3-4 shows a typical T1/FT1 Interface Results printout.

CONTROLS	PRINT		
10:43:06	16 JAN 91	SITE TTC	
DATA:	2^15-1	ERROR INS:	OFF
SELF LOOP:	ON	GEN CLOCK:	SYNTH
TIMING MODE:	N/A	SYN FRQ:	1544.0 kHz
INTERFACE:		FULL/FRAC T1	
FRAMING:	ESF	CODE:	AMI
INPUT:	TERM	LBO:	0 DB
RESULTS MODE:	STD		
REFT1:	TERM	ERR INS:	OFF
ERR TYPE:	LOGIC	IDLE:	01111111
LOOP:	CSU	RCVBYTE CHAN:	1
MODE:	FULLT1	SCAN:	11111111
11111111 11111111		TEST INT:	10^5
PRINT EVENT:	NOR	TEST INT PRNT:	OFF
SYNC LOSS PRINT:	OFF	ERROR PRNT	OFF
TIME PRNT:	OFF	ANALY MODE:	CON
DISPLAY HOLD:	OFF	BLOCK LENGTH:	
	1000 BITS	DELAY: DTR/	DTR/
XON CHARACTER:	11	XOFF CHARACTER:	13
AUX FUNC IN USE:	NONE		
PRINT SPEED:	FAST	PRINT TERM:	CR LF
REMOTE:	NONE	PRINTER:	RS-232
RS-232:		DATA BITS:	8
BAUD	9600	PARITY:	NONE

Figure 3-3
Controls Printout

MANUAL	PRINT		
10:42:02	16 JAN 91	SITE ID	TTC
BIT ERRS	6299	AVG BER	1.64E-04
BER	0. E-05	EA SEC	25
ERR EAS	1	EF EAS	24
BPVs	0	AVG BPVR	0. E-07
BPV Rate	0. E-05	CRC ERR	0
AVG CRC	0. E-03	CRC E Rt	0. E-01
FRA ERR	0	AVG FER	0. E-05
FE RATE	0. E-02	PAT SLIP	0
ELAP SEC	26	DELAY	99.5ms
+WNDR	No Ref	-WNDR	No Ref
PP WNDR	No Ref	15m WNDR	No Ref
24h WNDR	No Ref	TIE WNDR	No Ref
RCV FREQ	1544000	GEN FREQ	1544000
RCV COD	AMI	RCV BYT	11101110
FRA LOSS	0	PAT LOSS	0
PWR LOSS	0	SIG LOSS	0
YEL SEC	0	XSO SEC	0
AIS SEC	0	1s DEN S	25
SMPX CUR	Too Low	MAX ZERO	15
BIT SLIP	No Ref	RCV BOM	
+LVL V	2.97 V	+LVL dB	.0 dB
-LVL V	2.97 V	-LVL dB	.0 dB
PP LVL V	5.94 V	LVL dB	.0 dB
VF EAS	0	%VF EAS	100%
PATL SEC	0	%PAT SEC	100%
ERR-SES	4.00%	BER-SES	
%SES	0.00%	G%EFS	96.00%
AVL SEC	25	%DEG MIN	
G EFS	24	DEG MIN	0
GERR SEC	1	SES	1
UNA SEC	0	%AVL SEC	100.00%
If FULL/FRAC T1		FRAME SYNC	ABSENT
B8ZS	ABSENT	YELLOW ALARM	NO
EXCESS ZEROS	NO	SELF LOOP	ON

Figure 3-4
Results Printout

3.8 FIREBERD 6000 REMOTE CONTROL COMMANDS

The FIREBERD 6000 remote control commands enable remote control over the T1/FT1 Interface Module. The T1/FT1 remote control commands are listed in Table 3-2. The spacing used on each command line must be used as indicated. For detailed instructions on remotely controlling the FIREBERD 6000, refer to the *FIREBERD 6000 Reference Manual.*

Table 3-2
T1/FT1 Interface Module Remote Control Commands

Remote Command:	Result:
INTF:T1_FT1:CONFIG:FRAME? INTF:T1_FT1:CONFIG:FRAME (xxx)	Requests the current framing selection Sets the framing (xxx = OFF, ESF, D4, or SLC)
INTF:T1_FT1:CONFIG:CODE? INTF:T1_FT1:CONFIG:CODE (xxx)	Requests the current coding selection Sets the coding (xxx = AMI, or B8ZS)
INTF:T1_FT1:CONFIG:INPUT? INTF:T1_FT1:CONFIG:INPUT (xxx)	Requests the current input impedance Sets the input impedance (xxx = TERM, BRIDGE, or DSX_MON)
INTF:T1_FT1:CONFIG:LBO? INTF:T1_FT1:CONFIG:LBO (xxx)	Requests the current line build out (LBO) Sets the LBO (xxx = 0, -7.5, or -15)
INTF:T1_FT1:CONFIG:REFER_INPUT? INTF:T1_FT1:CONFIG:REFER_INPUT (xxx)	Requests the current reference input Sets the reference input (xxx = TERM, or BRIDGE)
INTF:T1_FT1:CONFIG:RESULT? INTF:T1_FT1:CONFIG:RESULT (xxx)	Requests the current analysis result selection Sets the analysis result (xxx = STD or LIVE)
INTF:T1_FT1:MODE? INTF:T1_FT1:MODE (xxx)	Requests the current mode of operation Sets the mode of operation (xxx = T1, FT1, FT1INS, VOICE, TLB, LLB, ESFDL, RS232, or T1_403)
INTF:T1_FT1:T1_403? INTF:T1_FT1:T1_403 (xxxx) INTF:T1_FT1:ERR_INSERT? INTF:T1_FT1:ERR_INSERT (xxx)	Requests the current T1.403 mode of operation Sets the T1.403 mode of operation (xxxx = CARR or CUST) Selects error insertion Sets the error insertion (xxx = OFF, BPV, LOGIC, L+BPV, SINGLE, RATE, 1FRAME, 2FRAME, 3FRAME, or 4FRAME)
INTF:T1_FT1:ERR_RATE? INTF:T1_FT1:ERR_RATE (xxx)	Requests the current error insertion rate Sets the error insertion rate between 1E-9 to 9E-3
INTF:T1_FT1:LOOP? INTF:T1_FT1:LOOP (xxx)	Requests the current loop code selected Sets the loop code (xxx = CSU, FAC1, FAC2, DL-LLB, DL-PLB, PROGRAM, or V.54)
INTF:T1_FT1:LOOP:PROGRAM? (xxx) INTF:T1_FT1:LOOP:PROGRAM (xxx), ("bbbbbbbb")	Requests whether the current programmed loop code for either the loop-up or loop-down code (xxx = UP or DOWN) Select either a loop-up or loop-down code (xxx = UP or DOWN) and program the loop code (bbbbbbbb = a 3- to 8-bit code of 1's and 0's)
INTF:T1_FT1:LOOP_RESP? INTF:T1_FT1:LOOP_RESP (xxxx)	Requests the current loop code response Sets the loop response (xxxx = NONE or AUTO)

Table 3-2
T1/FT1 Interface Module Remote Control Commands (Continued)

Remote Command:	Result:
INTF:T1_FT1:RECEIVE_CHANNEL?	Requests the current receive channel (1 - 24) that is displayed for the RCV BYTE result
INTF:T1_FT1:REVEIVE_CHANNEL (xx)	Sets the recieve channel (xx = 1 - 24) displayed for the RCV BYTE result
INTF:T1_FT1:RCV_CHAN?	Requests the currently selected receive channel RCV BYTE is the front panel equivalent
INTF:T1_FT1:RCV_CHAN (xx)	Sets a receive channel (xx = 1 - 24)
INTF:T1_FT1:FRACT1:TX? (xx)	Requests the current status of each transmit channel (xx = 1- 24) as either ON or OFF
INTF:T1_FT1:FRACT1:TX (xx),(yyy)	Sets the transmit channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FRACT1:TX_CHANNELS?	Requests the current status of each transmit channel
INTF:T1_FT1:FRACT1:RX? (xx)	Requests the current status of each receive channel (xx = 1-24) as either ON or OFF
INTF:T1_FT1:FRACT1:RX (xx),(yyy)	Sets the receive channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FRACT1:RX_CHANNELS?	Requests the current status of each receive channel
INTF:T1_FT1:FRACT1? INTF:T1_FT1:FRACT1 (xxx)	Requests the current Fractional T1 configuration Sets the current Fractional T1 configuration (xxx = AUTO, CLEAR, 64, or 56)
INTF:T1_FT1:FT1INS:TX? (xx)	Requests the current status of each transmit channel (xx = 1- 24) as either ON or OFF
INTF:T1_FT1:FT1INS:TX (xx),(yyy)	Sets the transmit channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FT1INS:TX_CHANNELS?	Requests the current status of each transmit channel
INTF:T1_FT1:FT1NS:RX? (xx)	Requests the current status of each receive channel (xx = 1-24) as either ON or OFF
INTF:T1_FT1:FT1INS:RX (xx),(yyy)	Sets the receive channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FT1INS:RX_CHANNELS?	Requests the current status of each receive channel
INTF:T1_FT1:FT1INS? INTF:T1_FT1:FT1INS (xxx)	Requests the current Fractional T1 drop and insert configuration Sets the current Fractional T1 drop and insert configuration (xxx = CLEAR, 56, or 64)
INTF:T1_FT1:VOICE? INTF:T1_FT1:VOICE (xx),(yy)	Requests the current voice transmit and receive channels Sets the Voice configuration transmit channel (xx = 1 - 24) and the receive channel (yy = 1 - 24)

Table 3-2
T1/FT1 Interface Module Remote Control Commands (Continued)

Remote Command:	Result:
INTF:T1 FT1:VOICE:SIGNAL?	Requests the current logic state of the ABCD signaling bits of the selected transmit channel
INTF:T1_FT1:VOICE:SIGNAL (xx)	Enable (ON) or disable (OFF) the robbed bit signaling (xx = ON or OFF)
INTF:T1_FT1:VOICE:SIGNAL:PATTERN?	Requests the current logic state of the ABCD signaling bits
INTF:T1_FT1:VOICE:SIGNAL:PATTERN (xxxx)	Program the logic state of the ABCD signaling bits (xxxx = up to 4 bits of 1's or 0's)
INTF:T1_FT1:RS232:CHANNEL?	Requests the currently selected transmit and receive channel
INTF:T1_FT1:RS232:CHANNEL (xx),(yy)	Sets the transmit channel (xx = 1 - 24) and the receive channel (yy = 1 - 24)
INTF:T1_FT1:RS232:CHAN_RATE? rate	Requests the currently selected transmit and receive channel
INTF:T1_FT1:RS232?	Requests the current configuration of the RS232 port
INTF:T1_FT1:RS232 (xxx)	Configures the RS232 port (xxx = DATALINK or CHANNEL)
INTF:T1_FT1:IDLE:PATTERN?	Requests the current idle pattern
INTF:T1_FT1:IDLE:PATTERN (xxx)	Sets the idle code (xxx = a 3- to 8-bit string of 1's or 0's)
INTF:T1_FT1:T1_403?	Requests the current T1.403 PRM mode.
INTF:T1_FT1:T1_403 (xxxx)	Sets the T1.403 PRM mode to customer emulation (CUST) or to carrier emulation (CARR)

3.9 FIREBERD 6000 SELF-LOOP TEST

The T1/FT1 Interface Module includes a relay that is activated by the **SELF LOOP** switch on the FIREBERD front panel. Pressing **SELF LOOP** loops the TX OUTPUT to RX INPUT. This provides a quick verification of the FIREBERD mainframe and interface. User connections do not need to be removed during the test, since complete isolation is provided by the relay when testing in the Self-Loop mode.

SECTION 4
FIREBERD 6000 APPLICATIONS

4.1 INTRODUCTION

This section shows how the T1/FT1 Interface Module can be used with the FIREBERD 6000 in a variety of test scenarios. Test and instrument set-ups are provided for:

1. End-to-End Fractional T1 Testing
2. CSU Loopback Testing
3. Installing and Troubleshooting Customer Premise Equipment
4. Fractional T1 Drop and Insert Testing

The procedures in this section assume that you possess a working knowledge of the T1/FT1 Interface Module and the FIREBERD 6000. If you are unfamiliar with the instruments, please refer to Section 3, Installation and Operation.

4.2 END-TO-END FRACTIONAL T1 TESTING

Figure 4-1 shows two FIREBERDs testing the performance of a Fractional T1 circuit end-to-end. End-to-end testing with the FIREBERD and T1/FT1 Interface enables you to evaluate and verify the end-to-end performance of the Fractional T1 service. This procedure requires two FIREBERDs. Both sides are tested using a pattern that is transmitted from both ends of the span.

The procedure in Table 4-1 verifies the performance of a 384 (6 x 64 kb/s) Fractional T1 circuit where channels 1 - 6 are used for data transmission.

NOTE: Perform all steps in Table 4-1 for the FIREBERD at each test location.

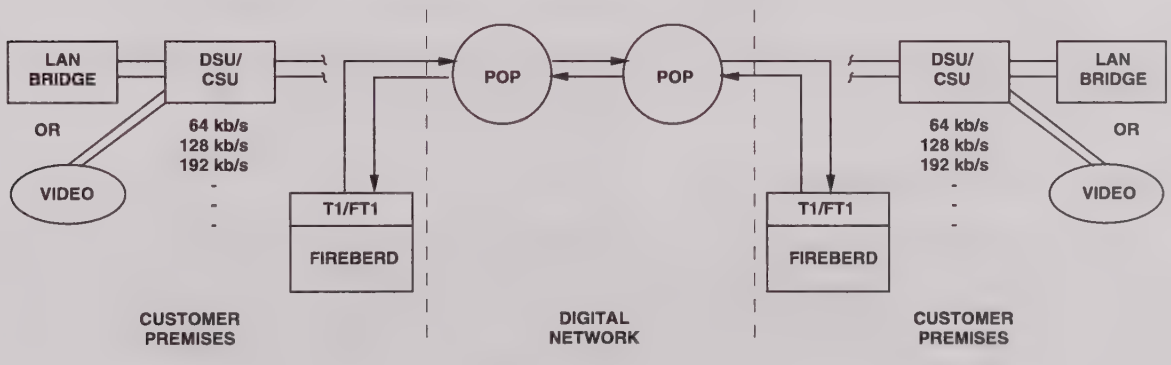

Figure 4-1
End-To-End Fractional T1 Testing

Table 4-1
End-To-End Fractional T1 Testing

Step:	Activity:
1.	With the power to theunit turned off, insert the T1/FT1 Interface Modulein the rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Select a test data pattern using the **DATA** switch. (Example: QRSS.)
4.	Set the **GEN CLK** switch to the INTF position to derive the transmit clock from the network.
5.	Using the **MENU** switch: a. Configure the T1/FT1 Interface Module using the INTF SETUP. Make these selections by pressing the MENU softkeys underneath their display. 1. T1/FT1 to select the T1/FT1 Data Interface. 2. CONFIG to access the configuration menu. 3. FRAME to select framing. (Example: ESF.) 4. CODE to select coding. (Example: B8ZS.) 5. INPUT to TERM. 6. Press the UP ARROW to access the main menu. 7. MODE to access the mode menu. 8. FRACT1 for fractional T1 testing. 9. Scroll through each channel 1 - 6 using the CHAN# softkey. Press the RX and TX softkeys to select channels 1 - 6. Press the **MORE** key and select the channel data rate Nx64. 10. Press the **UP ARROW** to access the main menu. 11. ERRINS to access the error insert menu. 12. OFF to turn the error insert off. 13. Press the **UP ARROW** to access the main menu. 14. IDLE to select the idle code.

Select the idle code using the left and right cursor keys and the 1 and 0 keys on the keypad. Press the **ENTER** key to save the changes. Common idle codes: 0111 1111 or 1111 1111.

4.3 CSU LOOPBACK TESTING

Figure 4-2 shows the FIREBERD 6000 performing a CSU loopback test. With the FIREBERD and T1/FT1 Interface, loopback tests can be performed using any in-band or out-of-band (ESF Data Link) loop codes. The instrument terminates the near-end of the T1 network and transmits data to and receives data from the far-end CSU. The FIREBERD sends a loop up code to the far-end CSU; the far end CSU goes into loopback toward the T1 network and the FIREBERD. By analyzing the received data for errors, the FIREBERD analyzes the performance of the network up to and including the far-end CSU.

Table 4-2 provides the procedures to configure the FIREBERD for an ESF CSU payload loopback test.

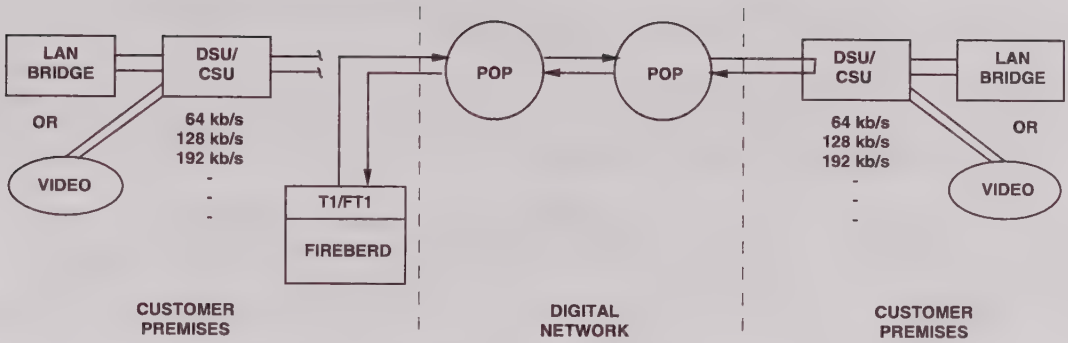

Figure 4-2
CSU Loopback Testing

Table 4-2
CSU Loopback Testing

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Select a test data pattern using the **DATA** switch. (Example QRSS.)
4.	Set the **GEN CLK** switch to the INTF position to derive the transmit clock from the network.
5.	Using the **MENU** switch: a. Configure the T1/FT1 Interface Module using the INTF SETUP. Make these selections by pressing the MENU softkeys underneath their display. 1. T1/FT1 to select the T1/FT1 Data Interface. 2. CONFIG to access the configuration menu. 3. FRAME to ESF. 4. CODE to select coding. (Example: B8ZS.) 5. INPUT to TERM. 6. Press the **UP ARROW** to access the main menu. 7. MODE to access the mode menu. 8. FULLT1 for T1 testing on the full payload bandwidth of 1.536 Mb/s. 9. Press the **UP ARROW** to access the main menu. 10. ERRINS to access the error insert menu. 11. OFF to turn the error insert off. 12. Press the **UP ARROW** to access the main menu. 13. LOOP to access the loop type menu. 14. DL-PLB to select ESF Payload Loopback Loop codes.
6.	Press the front panel **LOOP UP** switch to loop up the far-end CSU. When the test is complete press the front panel **LOOP DOWN** switch to loop down the CSU.

4.4 INSTALLING AND TROUBLESHOOTING CUSTOMER PREMISE EQUIPMENT

Figure 4-3 shows two FIREBERD 6000s accessing both the DTE and T1 network side of the Fractional T1 DSU/CSU. FIREBERD #1 is equipped with a V.35 Interface and FIREBERD #2 is equipped with a T1/FT1 Interface Module. By accessing both sides of the CPE, the FIREBERD can test for proper T1 timing and signal using slips, level, frequency, and jitter measurement while performing BERT analysis on the designated bandwidth.

The procedures in Tables 4-3 and 4-4 provide the configurations to test a fractional T1 DSU/CSU as a stand-alone piece of equipment. In this application, 256 kb/s (4 x 64 kb/s) bit error analysis is performed on four non-contiguous channels.

Table 4-3 describes the set-up procedures for FIREBERD #1. Table 4-4 describes the set-up procedures for FIREBERD #2.

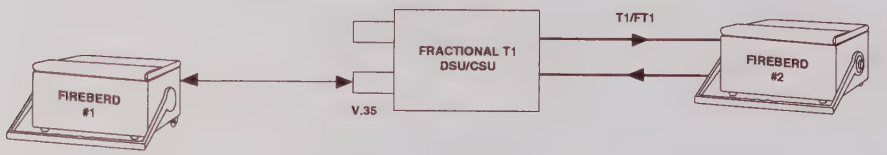

Figure 4-3
Installing and Troubleshooting Customer Premise Equipment

Table 4-3
FIREBERD #1

Step:	Activity:
1.	With the power to the unit turned off, insert the V.35 Interface Module in the rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Select a test data pattern using the **DATA** switch. (Example QRSS.)
4.	Set the **GEN CLK** switch to the INTF position to receive the clock from the DCE.
5.	Using the **MENU** switch: a. The V.35 Interface Module is not controllable by the FIREBERD 6000 front panel. Select the V.35 Interface using the switches on the interface as follows: 1. TRANSMIT CLOCK INVERT switch to NORMAL. 2. RECEIVE CLOCK INVERT switch to NORMAL. 3. TIMING MODE switch to 306.
6.	Illuminate the **RTS** and **DTR** switches, located above the **POWER** switch, to set both signaling leads HIGH.
7.	Set the **MENU** switch to SYNTH FREQ and set the synthesizer frequency to 256 kb/s.

Table 4-4
FIREBERD #2

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 6000.
	NOTE: If the FIREBERD 6000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Select a test data pattern using the **DATA** switch. (Example QRSS.)
4.	Set the **GEN CLK** switch to the INTF position to derive the transmit clock from the DCE.
5.	Using the **MENU** switch: a. Configure the T1/FT1 Interface Module using the INTF SETUP. Make these selections by pressing the MENU softkeys underneath their display. 1. T1/FT1 to select the T1/FT1 Data Interface. 2. CONFIG to access the configuration menu. 3. FRAME to select framing. (Example ESF.) 4. CODE to select coding. (Example AMI.) 5. INPUT to TERM. 6. Press the **UP ARROW** to access the main menu. 7. MODE to access the mode menu. 8. FRACT1 for Fractional T1 testing. 9. Scroll through the channels using the CHAN# softkey. Press the RX and TX softkeys to select channels 1, 3, 5, and 7. Press the **MORE** key and select the channel data rate Nx64. 10. Press the **UP ARROW** to access the main menu. 11. ERRINS to access the error insert menu. 12. OFF to turn the error insert off. 13. Press the **UP ARROW** to access the main menu. 14. IDLE to set the idle code.

Set the idle code using the left and right cursor keys and the 1 and 0 keys on the keypad. Press the **ENTER** key to save the changes.

4.5 T1/FT1 DROP AND INSERT

An end user has a 6x64 kb/s FT1 circuit, with four channels (1-4) used for video teleconferencing and two channels (5-6) used for PBX trunks. Because customers are only experiencing problems with the video circuit, the test objective is to troubleshoot the problem without taking the PBX trunks out of service.

In this application, a FIREBERD can perform a 256 kb/s (4x64 kb/s) BERT test without disrupting live traffic on the remaining channels (Figure 4-4). On the line side of the FT1 multiplexer, the FIREBERD equipped with a T1/FT1 Interface Module inserts a test pattern on channels 1-4; on the drop side of the FT1 multiplexer, the FIREBERD equipped with a data communications interface actually performs the BERT test. During this test, traffic on channels 5 and 6 passes unaltered.

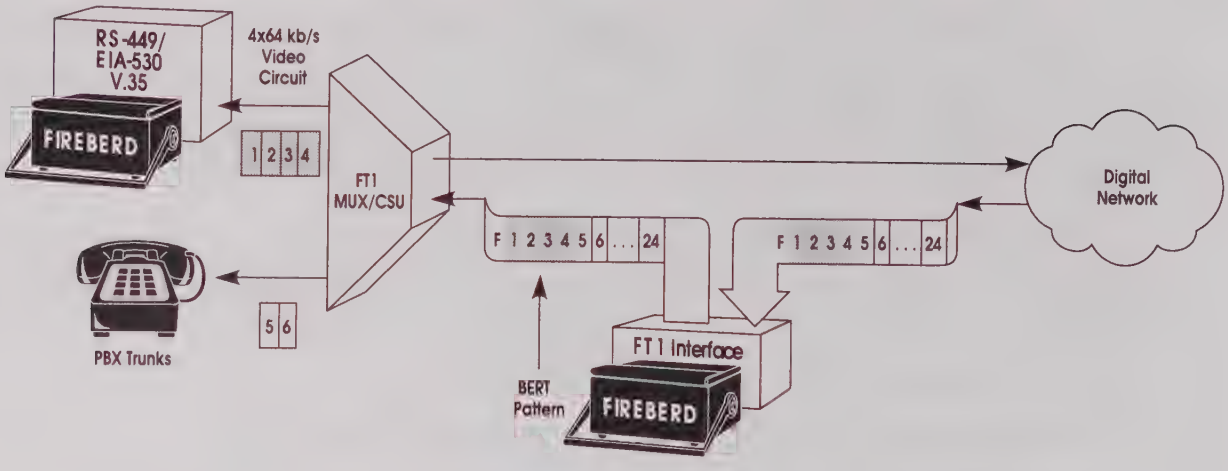

Figure 4-4
FT1 Drop and Insert Testing

Table 4-5 lists the set-up procedures for the FIREBERD on the drop side of the FT1 multiplexer (a V.35 interface is assumed); Table 4-6 lists the set-up procedures for the FIREBERD on the line side of the FT1 multiplexer (equipped with the T1/FT1 Interface Module). In this application, 256 kb/s (4 x 64 kb/s) bit error analysis is performed on four contiguous channels.

Table 4-5
FT1 Drop and Insert Testing (FIREBERD #1)

Step:	Activity:
1.	With the power to the unit turned off, insert the V.35 Interface Module in the rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 6000.
	NOTE: If the FIREBERD 6000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Select a test data pattern using the **DATA** switch. (Example QRSS.)
4.	Set the **GEN CLK** switch to the INTF position to receive the clock from the DCE.
5.	Using the **MENU** switch: a. The V.35 Interface Module is not controllable by the FIREBERD 6000 front panel. Select the V.35 Interface using the switches on the interface as follows: 1. TRANSMIT CLOCK INVERT switch to NORMAL. 2. RECEIVE CLOCK INVERT switch to NORMAL. 3. TIMING MODE switch to 306.
6.	Illuminate the **RTS** and **DTR** switches, located above the **POWER** switch, to set both signaling leads HIGH.
7.	Set the **MENU** switch to SYNTH FREQ and set the synthesizer frequency to 256 kb/s.

Table 4-6
FT1 Drop and Insert Testing (FIREBERD #2)

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Select a test data pattern using the **DATA** switch. (Example: QRSS.)
4.	Set the **GEN CLK** switch to the INTF position to derive the transmit clock from the network.
5.	Using the **MENU** switch: a. Configure the T1/FT1 Interface Module using the INTF SETUP. Make these selections by pressing the MENU softkeys underneath their display. 1. T1/FT1 to select the T1/FT1 Data Interface. 2. CONFIG to access the configuration menu. 3. FRAME to select framing. (Example: ESF.) 4. CODE to select coding. (Example: B8ZS.) 5. INPUT to TERM. 6. Press the **UP ARROW** to access the main menu. 7. MODE to access the mode menu. 8. FT1INS to select drop and insert testing. 9. Scroll through channels 1 - 4 using the CHAN# softkey. Press the RX and TX softkeys to select channels 1 - 4. Press the **MORE** key and select the channel data rate Nx64. 10. Press the **UP ARROW** to access the main menu. 11. ERRINS to access the error insert menu. 12. OFF to turn the error insert off. 13. Press the **UP ARROW** to access the main menu.

SECTION 5
FIREBERD 4000
INSTALLATION AND OPERATION

5.1 INTRODUCTION

This section describes how to install, configure, and operate the T1/FT1 Interface Module with a FIREBERD 4000. Refer to the *FIREBERD 4000 User's Guide* or the *FIREBERD 4000 Reference Manual* for mainframe operating procedures.

NOTE: Configure the FIREBERD 4000 and the T1/FT1 Interface Module before connecting the FIREBERD to the circuit under test. This avoids unnecessary circuit downtime.

5.2 INSTALLING THE INTERFACE

The following procedure describes how to install the T1/FT1 Interface Module into the FIREBERD 4000. Figure 5-1 illustrates how the interface is installed into the FIREBERD 4000 mainframe.

CAUTION:

BEFORE INSTALLING OR REMOVING THE INTERFACE MODULE, TURN THE FIREBERD MAINFRAME AC POWER OFF.

1. Turn the AC power OFF to the FIREBERD.

2. Face the FIREBERD rear panel. The FIREBERD 4000 may have two interface slots. SLOT1 (bottom slot) is the standard interface slot and SLOT2 (top slot) is the optional interface slot (Option 4001). Position the interface in the desired slot with the interface face plate facing out. Make sure the interface PC board edges are fitted into the card guides in the mainframe.

3. Slide the interface module into the FIREBERD until the back of the interface panel is flush with the mainframe rear panel.

4. Secure the interface in the mainframe by rotating the thumbscrews on the interface panel clockwise, until finger tight.

5. Turn the FIREBERD mainframe AC power ON and configure the FIREBERD and interface as described in the following sections.

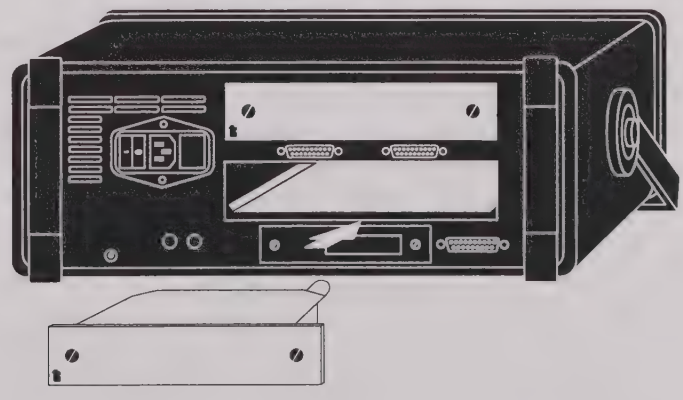

Figure 5-1
FIREBERD 4000 Interface Installation

5.3 FIREBERD 4000 MAINFRAME SET-UP

Perform this procedure to configure the FIREBERD 4000 with the T1/FT1 Interface.

1. Turn the AC power ON. If necessary, press the **SELF LOOP** switch to extinguish its LED before continuing.

2. Connect the T1 signal source to the interface bantam connector marked RX INPUT and the T1 output to the bantam connector marked TX OUTPUT (as applicable).

3. If timing slips measurements are to be performed, connect the T1 reference signal source to the bantam connector marked T1 REF.

4. Press the **SETUP CATEGORY** switch and select the INTERFACE category. Press the T1/FT1 softkey to select the T1/FT1 Interface Module. Configure the interface for operation.

5. Press the **SETUP CATEGORY** switch and select the GENERATOR CLOCK category. Select a timing source. To select a timing source other than SYNTH requires an external clock source from either the network or from another source.

6. Press the **SETUP CATEGORY** switch and select the PATTERN category. Select the desired test pattern by pressing the appropriate softkey (and **MORE** key).

7. Set the ANALYSIS RESULT, ANALYSIS MODE, and PRINTER as required.

5.4 FIREBERD 4000 INTERFACE MENU

The following information describes how to access the T1/FT1 Interface menu and discusses each of the menu selections available.

5.4.1 FIREBERD 4000 Interface Menu Control

The T1/FT1 Interface menu is selected through the mainframe INTERFACE SETUP category. Press the T1/FT1 softkey to access the T1/FT1 Interface menu. Use the **SETUP SELECT** switch to step through the menus (see Figure 5-2). Press the softkeys to select a function as indicated by the softkey labels on the bottom line of the display. To return to the interface select menu, press the mainframe **HOME** key. All interface menu settings are retained when mainframe power is turned off.

5.4.2 Framing Menu

FRAME - Select the framing format for transmission and analysis.

OFF - Selects unframed data and performs data analysis on the full 1.544 Mb/s bandwidth of the T1 line. No framing bits are added during transmission and no data bits are stripped during reception.

ESF - Allows the FIREBERD to transmit and analyze T1 signals with Extended SuperFrame (ESF) framing. With ESF-framed signals, the framing pattern occupies 2 kb/s, the CRC check bits occupy 2 kb/s, the data link occupies 4 kb/s, and the selected data pattern occupies the remaining 1.536 Mb/s.

Figure 5-2
FIREBERD 4000 Menu Tree

D4 - Allows the FIREBERD to transmit and analyze T1 signals with D4 (Superframe) framing. D4 framing occupies 8 kb/s of the 1.544 Mb/s bandwidth and the selected data pattern occupies the remaining 1.536 Mb/s. The D4 framing pattern is compatible with D1D, D2, D3, and D4 channel banks.

SLC - Allows transmission and analysis of T1 signal with SLC-96 framing. SLC-96 framing and the control channel occupy 8 kb/s of the 1.544 Mb/s bandwidth, with the selected data pattern occupying the remaining 1.536 Mb/s.

NOTE: With the ESF, D4, and SLC framing selected, the receiver frequency measurements are available only when the data interface is in continuous frame synchronization with the incoming data. If there is intermittent frame synchronization or no frame synchronization at all (i.e., unframed data), receiver frequency measurements may be obtained by setting the FRAME menu to OFF.

5.4.3 Coding Menu

CODE - Determines whether the FIREBERD transmits with AMI-encoded data or B8ZS clear-channel encoding.

AMI - Allows Alternate Mark Inversion (AMI) coding. AMI is encoded by transmitting a pulse of alternating polarity for each one (MARK) and no pulse for each zero (SPACE). The pulse is active for the first half of the bit time period.

B8ZS - Selects Bipolar with 8 Zero Substitution (B8ZS) coding for the transmitted signal. B8ZS also transmits a pulse of alternating polarity for each one and no pulse for each zero, except for strings containing 8 consecutive zeros which are replaced by a zero substitution code. This causes a series of 8 zeros to be replaced by 000V10V1, where 0 represents a SPACE, 1 represents a MARK, and V represents a bipolar violation. The B8ZS decoder restores a detected B8ZS pattern to the original 8 zeros.

5.4.4 Input Menu

INPUT - Allows selection of input impedance and signal conditioning.

TERM - Selects normal operation, terminating the input with 100 ohms and accepting a T1 signal attenuated with between +6 dB and -35 dB due to cable loss.

BRIDGE - Allows monitoring of T1 lines that are already terminated. In BRIDGE mode, the input impedance is greater than 1000 ohms and accepts signals attenuated between +6 dB and -35 dB due to cable loss.

DSXMON - Conditions the receiver to operate with signals from DSX-Monitor ports. In this mode, the input accepts T1 signals resistively attenuated between 10 dB and 30 dB, and terminates the line with 100 ohms.

5.4.5 Line Build Out Menu

LBO - Allows emulation of three different cable losses for the T1 output (0 dB, -7.5 dB, or -15 dB). The selected cable loss affects the transmit data only at the connectors.

0dB - Sets the primary output (TX) to the DSX level with no line build out (0 dB attenuation).

-7.5dB - Provides a -7.5 dB line build out, attenuating the output with 7.5 dB of simulated cable loss.

-15dB - Provides a -15 dB line build out, attenuating the output with 15 dB of simulated cable loss.

NOTE: When changing the line build out level, an errored second or loss of synchronization may occur.

5.4.6 Mode Menu

MODE - The mode menu allows the user to select the transmit and receive data operating mode.

FULLT1 - Configures the FIREBERD to transmit and receive data at the full T1 rate. The data transmitted is framed or unframed depending on the FRAME selection in the CONFIG menu. Note that when FRAME is set to OFF, FULLT1 is the only available MODE selection.

FRACT1 - Allows data to be transmitted and received at any Fractional T1 rate of Nx64 kb/s or Nx56 kb/s (N=1...24) on any selection of contiguous or non-contiguous time slots.

CH# UP - Select the channel numbers which are to be isolated and tested on the respective transmit or receive channel. Pressing the CH# UP softkey scrolls through the channel numbers (01 to 24). The channel number(s) can be selected contiguously or non-contiguously.

CH# DN - Select the channel numbers which are to be isolated and tested on the respective transmit or receive channel. Pressing the CH# DN softkey scrolls through the channel numbers (24 to 01). The channel number(s) can be selected contiguously or non-contiguously.

TX/RX - Allows the user to select whether the displayed channel is active on the Fractional T1 signal generated by the FIREBERD. A transmit channel is identified as ON when TX is displayed next to the selected channel. A receive channel is identified as ON when RX is displayed on the top line. A channel is identified as OFF when "- -" is displayed on the top line instead of RX or TX. Repeatedly pressing the TX/RX softkey toggles the channel through the following four choices:

```
TX/RX
TX/- -
- -/RX
- -/- -
```

AUTO - Activates auto-configuration. Auto-configuration scans all receive channels looking for the idle code (set by the IDLE menu). Channels that do not match the idle code are assumed to be active and the transmit channel is set ON. `Scanning...` is visible in the display while the channels are being scanned.

CLRALL - Clears all of the currently selected channels.

56/64 - Selects the channel bandwidth for either Nx56 kb/s or Nx64 kb/s data analysis. Note that the T1-mW pattern is only for 1 x 64 kb/s bandwidth use.

FT1INS - Selects the FT1 insert operating mode, which allows you to insert a BERT pattern on any combination of selected Nx64 kb/s or Nx56 kb/s timeslots without disrupting traffic on the remaining timeslots. *FT1INS differs from FRACT1 operation in that unused timeslots at the FIREBERD's output contain data received in that timeslot.* Refer to the FRACT1 menu for a description of FT1INS items.

Note that the FT1INS set up is identical to FRACT1, except that the unused timeslots are filled with received data (in lieu of the eight-bit idle code). Also note that this mode is not valid with SELF LOOP.

VOICE - Select this menu when monitoring voice channels or ABCD signaling bits or when transmitting voice or ABCD signaling bits.

SEL < - Sets the transmit and/or receive status for the selected voice channel.

CH# UP - Selects the voice channel from 01 to 24.

CH# DN - Selects the voice channel from 24 to 01.

SIG ABCD - Allows the user to set the ABCD robbed bit signaling on the selected transmit channel.

SET0 - Sets the bit value at the cursor position to 0 and moves the cursor one position to the right.

SET1 - Sets the bit value at the cursor position to 1 and moves the cursor one position to the right.

ON/OFF - Sets the ABCD signaling bits on or off for the selected transmit channel.
The signaling bits transmitted are determined by the FRAME selection in the CONFIG menu. The following describes the signaling bits associated with each FRAME selection:

- ESF - A, B, C, and D
- D4 - A and B
- SLC - A and B
- OFF - None

TLB - Selects Test Loopback (TLB). This selection emulates a CSU or a channel bank in digital loopback. All received data is echoed on the transmitter output and the received signal is analyzed by the FIREBERD data receiver. The ERRINS and CODE menu selections remain active. BPVs and B8ZS coding are stripped from the received signal. The outgoing signal is re-timed and re-encoded with AMI or B8ZS according to the CODE menu selection. BPV, logic, or logic & BPV errors can be inserted depending on the ERRINS menu selection.

LLB - Selects Line Loopback (LLB). This selection causes the interface to act as a repeater. All data received is echoed and unchanged on the transmitter output. This selection may be used to emulate a Channel Service Unit (CSU) in line loopback mode. The received signal is analyzed by the FIREBERD data receiver. Note that if LLB is selected, logic errors or BPVs cannot be inserted and the signal cannot be re-encoded. The ERRINS and CODE menus are still displayed after a warning message.

ESFDL - Configures the FIREBERD to receive and transmit data patterns on the 4 kb/s ESF data link. The 24 timeslots of the transmit signal are filled with the selected idle code.

RS232 - Configures the RS-232 port to transmit and receive.

SEL< - Sets the selected channel on the RS-232 port to transmit and/or receive synchronous data using an external device. Select choices are:

```
TX:01<RX:01<
TX:01 RX:01<
TX:01<RX:01
```

CH# UP - Selects the channels (01 to 24) on the RS-232 port to receive and/or transmit synchronous data using an external device.

CH# DN - Selects the channels (24 to 01) on the RS-232 port to receive and/or transmit synchronous data using an external device.

56/64 - Selects the synchronous data rate for the selected channel.

DATLNK - Configures the RS-232 port to drop the 4 kb/s ESF Data Link to an external device and to insert 4 kb/s synchronous data from an external device onto the ESF data link.

5.4.7 Idle Selection Menu

IDLE - The idle selection menu allows the user to select an 8-bit idle code and to identify which channels contain the specified idle code on the received input signal.

Program the idle code using the SET0 and SET1 softkeys. Position the cursor with the left or right cursor key. After setting the desired idle code, press the **ENTER** key to save the new idle code. If the **ENTER** key is not pressed, the previous idle code is still resident in memory.

SET0 - Sets the bit value at the cursor position to 0 and moves the cursor one position to the right.

SET1 - Sets the bit value at the cursor position to 1 and moves the cursor one position to the right.

5.4.8 Error Insert Menu

ERRINS - The error insert menu allows BPV, logic, or frame errors to be inserted one at a time or at the rate of 1E-6. Note that this menu is not available if the LLB MODE is selected.

OFF - The error insert capability is disabled.

SINGLE - Causes a single error to be inserted into the data stream. The error inserted is either a BPV, logic, or logic & BPV depending on the selected error type.

1E-6 - Allows the user to set the BPV and LOGIC error insertion rate to 1E-6.

NOTE: The internal synthesizer must be set to 1544 kHz.

BPV - Causes bipolar violation (coding) errors to be inserted at the rate of 1E-6.

LOGIC - Causes logic errors to be inserted at the rate of 1E-6. The logic error may fall on any bit, either data or framing, within the entire bandwidth.

L+BPV - Causes logic and BPV errors to be inserted simultaneously at the rate of 1E-6. This type of error typically occurs on a repeatered line due to the addition or deletion of a pulse.

1FRAME - Inserts a single frame error into the framing pattern each time the softkey is pressed.

2FRAME - Inserts two consecutive frame errors into the framing pattern each time the softkey is pressed.

3FRAME - Inserts three consecutive frame errors into the framing pattern each time the softkey is pressed.

4FRAME - Inserts four consecutive frame errors into the framing pattern each time the softkey is pressed.

NOTE: The softkeys 1FRAME, 2FRAME, 3FRAME, and 4FRAME are available when in any framing mode. Pressing any of these softkeys will set RATE to OFF. The FRAME errors are inserted on the F^t bits (D4/SLC 96) or the FPS bit (ESF).

5.4.9 Loop Type Menu

LOOP - Selects the loop code sequence transmitted through the active DS0 channels or through the ESF data link when the front panel **LOOP UP** and **LOOP DOWN** switches are pressed.

CSU - Channel Service Unit. Selects repeating in-band CSU loop codes; loop up: 10000 and loop down: 100.

FAC1 - Facility Type 1. Selects network interface (or smart jack) loop codes are transmitted by the FIREBERD. In-band repeating 4-bit loop codes: loop up 1100 and loop down 1110.

FAC2 - Facility Type 2. Selects network interface (or smart jack) loop codes are transmitted by the FIREBERD. In-band repeating 5-bit loop codes: loop up 11000 and loop down 11100.

DL-LLB - Out-of-band Data Link Line Loopback loop codes are transmitted and recognized by the FIREBERD on the ESF data link. This code is transmitted to the far end equipment to place the far end equipment into a line loopback. ESF out-of-band line loopback loop codes: loop up 1111 1111 0111 0000 and loop down 1111 1111 0001 1100. The left-most bit is transmitted first.

DL-PLB - Out-of-band Data Link Payload Loopback loop codes are transmitted and recognized by the FIREBERD on the ESF data link. This code is transmitted to the far end equipment to place the far end equipment into a payload loopback. The CSU loops back the payload data, reframes the signal, and recalculates the CRCs. ESF out-of-band payload loopback loop codes: loop up 1111 1111 0010 1000 and loop down 1111 1111 0100 1100. The left-most bit is transmitted first.

PRGM - Programmable in-band loop codes are transmitted by the FIREBERD. The programmable loop codes can be 3-8 bits in length.

V54 - In-band loopback transmitted over a Fractional T1 channel.

Program the loop code using the SETUP keypad and softkeys. Position the cursor with the left and right cursor keys. Use the softkeys INSRT1 and INSRT0 to enter a loop code. Use the DELETE softkey to remove a bit from the loop code. Press the **ENTER** key to save and implement loop code changes. Up to eight bits of the loop code may be programmed.

PRGM UP - Selects the programmed loop-up code. The default loop-up code is 10000.

DELETE - Deletes a character from the loop code bit string.

INSRT0 - Inserts a zero in the loop code bit string.

INSRT1 - Inserts a one in the loop code bit string.

PRGM DN - Selects the programmed loop-down code. The default loop-down code is 1000.

DELETE - Deletes a character from the loop code bit string.

INSRT0 - Inserts a zero in the loop code bit string.

INSRT1 - Inserts a one in the loop code bit string.

5.4.10 Loop Code Response Selection Menu

LOOPCODE RSPONSE - This menu determines the response to received loop codes. Press the softkey below the desired response to be taken when the loop code is received. Loop code response choices are:

AUTO - Selects line loopback if the loopback code is received.

NONE - Ignores any loopback codes received.

5.4.11 Receive Byte Selection Menu

RCVBYT - This menu selects which channel is displayed in the received byte result (RCV BYTE) display. This result is displayed in the INTERFACE results category.

CHAN# - Press this softkey to scroll through each channel and display the byte value of the selected channel. This value can also be viewed in the ANALYSIS RESULT SIGNAL CATEGORY under the RCV BYTE result.

5.4.12 Reference T1 Menu

REF T1 - Allows selection of the input impedance and signal conditioning for the T1 reference signal.

TERM - Selects normal operation, terminating the T1 reference input with 100 ohms and accepting a relatively unattenuated (+6 to -6 dB) T1 reference.

BRDG - Allows monitoring of reference T1 lines that are already terminated. In this mode, the input exhibits an impedance greater than 1000 ohms. Use BRDG at monitoring points.

5.5 FIREBERD 4000 ANALYSIS RESULTS

Table 5-1 lists the analysis results that are displayed when the T1/FT1 Interface Module is installed in the FIREBERD 4000. Refer to the *FIREBERD 4000 Reference Manual* for the results definitions not described in this section.

Table 5-1
FIREBERD 4000 Analysis Results

Category:	Displayed Result:	Description:
ERROR	AVG BER	Average Bit Error Rate
	AVG BLER	Average Block Error Rate
	BER	Biter Error Rate
	BIT ERRS	Bit Errors
	PAT LOSS	Pattern Synchronization Loss
	PAT SLIP	Pattern Slip
INTERFACE	AVG BPVR	Average Bipolar Violation Rate
	AVG CRC	Average CRC Error Rate
	AVG FER	Average Frame Error Rate
	BPVs	Bipolar Violations
	BPV Rate	BPV Rate

Table 5-1
FIREBERD 4000 Analysis Results (Continued)

Category:	Displayed Result:	Description:
INTERFACE (Continued)	BIT SLIP	Bit Slips
	CRC ERR	CRC Errors
	FRA ERR	Frame Errors
	MAX 0's	Max Zero's
	RCV BOM	Receive Bit Oriented Message
	RCV BYTE	Receive Byte
	RCV CODE	Receive Code
	SMPX CUR	Simplex Current
TIME & SIGNAL	+LVL V	Positive Receive Level in V
	-LVL V	Negative Receive Level in V
	+LVL dB	Positive Receive Level in dB
	-LVL dB	Negative Receive Level in dB
	%EFS	Percent of Error-Free Seconds
	DATE	Date
	ELAP SEC	Elapsed Seconds
	ERR SEC	Errored Seconds
	GEN FREQ	Generator Frequency
	LVL dBm	Level in dB
	PATL SEC	Pattern Loss Seconds
	PP LVL V	Peak-to-Peak Receive Level
	RCV FREQ	Receive Frequency
	TEST SEC	Test Seconds
	TIME	Time
PERFORMANCE	%AVL SEC	Percent of Available Seconds
	%DEG MIN	Percent of Degraded Minutes
	%SES	Percent of Severely Errored Seconds
	AVL SEC	Available Seconds
	DEG MIN	Degraded Minutes
	G %EFS	G.821 Percent of Error Free Seconds
	G EFS	G.821 Error Free Seconds
	GERR SEC	G.821 Errored Seconds
	SES	Severely Errored Seconds
	UNA SEC	Unavailable Seconds

Results unique to the T1/FT1 Interface Module are described in the following paragraphs.

INTERFACE Results Category

BIT SLIP - Bit Slips

The number of bit slips which occur relative to the T1 reference signal.

MAX 0's - Maximum Zeros

The maximum number of consecutive zeros received since the last test restart (0 - 255). Note that when a value of 255 is displayed, it actually means that the maximum number of consecutive zeros since the last test restart is *255 or greater.*

RCV BOM - Received Bit Oriented Message

Displays the ASCII message of the Bit Oriented Message on the ESF data link per ANSI Document T1.403. This result is only available when FRAME is set to ESF.

Possible ASCII messages:

YEL ALM - yellow alarm
LLB ACT - line loopback activated
LLB DEA - line loopback deactivated
PLB ACT - payload loopback activated
PLB DEA - payload loopback deactivated

NOTE: The remaining messages are displayed in binary.

RCV BYTE - Receive Byte
The received data bytes displayed in binary form, as follows: 12345678 Bit Number
xxxxxxxx ← Least Significant Bit

RX ABCD - Receive ABCD
Displays the ABCD signal of the selected DS0 channel while in VOICE MODE.

SMPX CUR - Simplex Current (in mA)
The value of the simplex current flowing between the transmit output tip and ring and the receive input tip and ring. Positive simplex current is received at the RX INPUT and transmitted at the TX OUTPUT connector.

TIME Results Category

+LVL dB - Positive Receive Level (in dB)
The level of the received signal in dB, relative to the positive level measurement. This measurement can range between 6 dB and -39 dB. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

-LVL dB - Negative Receive Level (in dB)
The level of the received signal in dB, relative to the negative level measurement. This measurement can range between 6 dB and -39 dB. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

+LVL V - Positive Receive Level (in V)
The level of the received signal in V, measured on the positive T1 pulses. This measurement can range between +6.0 V and +34.0 mV. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

-LVL V - Negative Receive Level (in V)
The level of the received signal in V, measured on the negative T1 pulses. This measurement can range between +6.0 V and +34.0 mV. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

LVL dBm - Receive Level (in dBm)
The power level of an unframed all-ones signal (available only when AIS is detected).

PP LVL V - Peak-to-Peak Receive Level (in V p-p)
The level of the received signal in peak-to-peak volts. This measurement can range from +12.0 V to +67.0 mV. If the measurement exceeds this range the message `TOO HIGH` or `TOO LOW` is displayed.

5.6 INTERFACE STATUS INDICATORS AND SWITCHES

When the T1/FT1 Interface Module is used, the mainframe identifies the interface status indicators and switches as follows: FRM SYNC, CODE, ALM 1, ALM 2, ALM 3, LOOP UP, and LOOP DOWN.

The FRM SYNC LED illuminates when the interface is configured to receive a signal with ESF, D4, or SLC framing at any rate and the interface has synchronized on the appropriate framing pattern. The CODE LED illuminates when the interface receives a B8ZS-encoded T1 signal. The ALM 1 LED illuminates when a yellow alarm is detected. The ALM 2 LED illuminates when an excess zeros alarm is detected. The ALM 3 LED illuminates when an AIS is detected.

When the **LOOP UP** switch is pressed and released, the selected loopback sequence is transmitted to the appropriate terminal. The switch is illuminated while the loopback is being established. Pressing and releasing the **LOOP DOWN** switch transmits the appropriate release loop code. The switch is illuminated while the release loop code is being transmitted. Depending on the loop codes sent, status messages appear in the Results Analysis display.

5.7 FIREBERD 4000 PRINTER OPERATION

Refer to the *FIREBERD 4000 Reference Manual* for printer set-up and operating instructions. Figure 5-3 is a typical T1/FT1 Interface Module Controls printout. Figure 5-4 shows a typical T1/FT1 Interface Results printout.

```
CONTROLS PRINT                  15:32:03 16 JAN 91
PATTERN              2^15-1     ERROR INSERT        OFF
SELF LOOP              ON       GEN CLOCK         SYNTH
SYN FRQ         1544.0 kHz      DISPLAY HOLD        OFF
SETUP PROGRAM NO. 0
AUXILIARY SETUP
FLOW TR/DTR            OFF      FLOW DM/DSR         OFF
FLOW RS/RTS            OFF      FLOW CS/CTS         OFF
FLOW RR/RLSD           OFF      SYN LOS ACT        HALT
SYN LOS THR         NORMAL      USER SYN THR         10
BLOCK LENGTH          PATT      PRINT FMT          LONG
STATUS PRINTS          OFF      PRINT EVENT         OFF
INTERFACE SLOT2                 T1/FT1
FRAME                  ESF      CODE                AMI
INPUT                 TERM      LBO                 0dB
MODE                FULLT1      ERRINS TYPE       LOGIC
ERRINS RATE            OFF      LOOP TYPE           CSU
REF T1              BRIDGE
```

Figure 5-3
Controls Printout

MANUAL PRINT		15:31:01 16 JAN 91	
BIT ERRS	0	AVG BER	0. E-07
BER		PAT SLIP	0
BLK ERRS	0	BLOCKS	13581090
AVG BLER	0. E-07	PAT LOSS	0
PATL SEC	9	ERR SEC	0
%EFS	100.00%	TEST SEC	8
ELAP SEC	0	GEN FREQ	1544000
RCV FREQ	1544000	BPVs	0
AVG BPVR	0. E-07	BPV Rate	
FRA ERR	0	AVG FER	0. E-04
CRC ERR	0	AVG CRC	0. E-07
RCV COD	AMI	RCV BOM	
MAX 0's	15		
BIT SLIP	No Ref		
+LVL V	3.00 V	+LVL dB	.0 dB
-LVL V	3.00	-LVL dB	.0 dB
PP LVL V	6.00	LVL dBm	
SMPX CUR	Too Low	AVL SEC	8
UNA SEC	0	%AVL SEC	100.00%
DEG MIN	0	%DEG MIN	
G EFS	8	GERR SEC	0
G %EFS	100.00%	SES	0
%SES	0.00%	B8ZS	ABSENT
YELLOW ALARM	NO	EXCESS ZEROS	NO
AIS	ABSENT	SELF LOOP	ON

Figure 5-4
Results Printout

5.8 FIREBERD 4000 REMOTE CONTROL COMMANDS

The FIREBERD 4000 remote control commands enable remote control over the T1/FT1 Interface Module. The T1/FT1 remote control commands for software Rev. 5 are listed in Table 5-2. The remote control commands listed in Table 5-2 conform with the IEEE-488.2 syntax. The spacing used on each command line must be used as indicated. For detailed instructions on remotely controlling the FIREBERD 4000, refer to the *FIREBERD 4000 Reference Manual*. For a list of remote control commands for software Rev. 4 equipped FIREBERD 4000 mainframes, refer to Appendix B in this manual.

Table 5-2
T1/FT1 Interface Module Remote Control Commands

Remote Command:	Result:
INTF:T1_FT1:CONFIG:FRAME? INTF:T1_FT1:CONFIG:FRAME (xxx)	Requests the current framing selection Sets the framing (xxx = OFF, ESF, D4, or SLC)
INTF:T1_FT1:CONFIG:CODE? INTF:T1_FT1:CONFIG:CODE (xxx)	Requests the current coding selection Sets the coding (xxx = AMI, or B8ZS)
INTF:T1_FT1:CONFIG:INPUT? INTF:T1_FT1:CONFIG:INPUT (xxx)	Requests the current input impedance Sets the input impedance (xxx = TERM, BRIDGE, or DSX_MON)
INTF:T1_FT1:CONFIG:LBO? INTF:T1_FT1:CONFIG:LBO (xxx)	Requests the current line build out Sets the line build-out (xxx = 0, -7.5, or -15)
INTF:T1_FT1:CONFIG:REFER_INPUT? INTF:T1_FT1:CONFIG:REFER_INPUT (xxx)	Requests the current reference input Sets the reference input (xxx = TERM, or BRIDGE)
INTF:T1_FT1:CONFIG:RESULT? INTF:T1_FT1:CONFIG:RESULT (xxx)	Requests the current analysis result selection Sets the analysis result (xxx = STD or LIV)
INTF:T1_FT1:MODE? INTF:T1_FT1:MODE (xxx)	Requests the current mode of operation Sets the mode of operation (xxx = T1, FT1, FT1INS, VOICE, TLB, LLB, ESFDL, RS232, or T1_403)
INTF:T1_FT1:T1_403? INTF:T1_FT1:T1_403 (xxxx) INTF:T1_FT1:ERR_INSERT? INTF:T1_FT1:ERR_INSERT (xxx)	Requests the current T1.403 mode of operation Sets the T1.403 mode of operation (xxxx = CARR or CUST) Selects error insertion Sets the error insertion (xxx = OFF, BPV, LOGIC, L+BPV, SINGLE, 1E-6, 1FRAME, 2FRAME, 3FRAME, or 4FRAME)
INTF:T1_FT1:LOOP? INTF:T1_FT1:LOOP (xxx)	Requests the current loop code selected Sets the loop code (xxx = CSU, FAC1, FAC2, DL-LLB, DL-PLB, PROGRAM, or V.54)
INTF:T1_FT1:LOOP:PROGRAM? (xxx) INTF:T1_FT1:LOOP:PROGRAM (xxx), ("bbbbbbbb")	Requests whether the current programmed loop code for either the loop-up or loop-down code (xxx = UP or DOWN) Select either a loop-up or loop-down code (xxx = UP or DOWN) and program the loop code (bbbbbbbb = a 3- to 8-bit code of 1's and 0's)
INTF:T1_FT1:LOOP_RESP? INTF:T1_FT1:LOOP_RESP (xxxx)	Requests the current loop code response Sets the loop response (xxxx = NONE or AUTO)
INTF:T1_FT1:RECEIVE_CHANNEL? INTF:T1_FT1:REVEIVE_CHANNEL (xx)	Requests the current receive channel (1 - 24) that is displayed for the RCV BYTE result Sets the recieve channel (xx = 1 - 24) displayed for the RCV BYTE result
INTF:T1_FT1:RCV_CHAN? INTF:T1_FT1:RCV_CHAN (xx)	Requests the currently selected receive channel RCV BYTE is the front panel equivalent Sets a receive channel (xx = 1 - 24)
INTF:T1_FT1:FRACT1:TX (xx)?	Requests the current status of each transmit channel (xx = 1 - 24) as either ON or OFF

Table 5-2
T1/FT1 Interface Module Remote Control Commands (Continued)

Remote Command:	Result:
INTF:T1_FT1:FRACT1:TX (xx),(yyy)	Sets the transmit channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FRACT1:TX_CHANNELS?	Requests the current status of each transmit channel
INTF:T1_FT1:FRACT1:RX (xx)?	Requests the current status of each receive channel (xx = 1 -24) as either ON or OFF
INTF:T1_FT1:FRACT1:RX (xx),(yyy)	Sets the receive channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FRACT1:RX_CHANNELS?	Requests the current status of each receive channel
INTF:T1_FT1:FRACT1? INTF:T1_FT1:FRACT1 (xxx)	Requests the current Fractional T1 configuration Sets the current Fractional T1 configuration (xxx = AUTO, CLEAR, 64, or 56)
INTF:T1_FT1:FT1INS:TX? (xx)	Requests the current status of each transmit channel (xx = 1 - 24) as either ON or OFF
INTF:T1_FT1:FT1INS:TX (xx),(yyy)	Sets the transmit channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FT1INS:TX_CHANNELS?	Requests the current status of each transmit channel
INTF:T1_FT1:FT1NS:RX? (xx)	Requests the current status of each receive channel (xx = 1 -24) as either ON or OFF
INTF:T1_FT1:FT1INS:RX (xx),(yyy)	Sets the receive channel (xx = 1 - 24) and the channel status (yyy = ON, or OFF)
INTF:T1_FT1:FT1INS:RX_CHANNELS?	Requests the current status of each receive channel
INTF:T1_FT1:FT1INS? INTF:T1_FT1:FT1INS (xxx)	Requests the current Fractional T1 drop and insert configuration Sets the current Fractional T1 drop and insert configuration (xxx = CLEAR, 56, or 64)
INTF:T1_FT1:VOICE? INTF:T1_FT1:VOICE (xx),(yy)	Requests the current voice transmit and receive channels Sets the Voice configuration transmit channel (xx = 1 - 24) and the receive channel (yy = 1 - 24)
INTF:T1_FT1:VOICE:SIGNAL?	Requests the current logic state of the ABCD signaling bits of the selected transmit channel
INTF:T1_FT1:VOICE:SIGNAL (xx)	Enable (ON) or disable (OFF) the robbed bit signaling (xx = ON or OFF)
INTF:T1_FT1:VOICE:SIGNAL:PATTERN? INTF:T1_FT1:VOICE:SIGNAL:PATTERN (xxxx)	Requests the current logic state of the ABCD signaling bits Program the logic state of the ABCD signaling bits (xxxx = up to 4 bits of 1's or 0's)
INTF:T1_FT1:RS232:CHANNEL? INTF:T1_FT1:RS232:CHANNEL (xx),(yy)	Requests the currently selected transmit and receive channel Sets the transmit channel (xx = 1 - 24) and the receive channel (yy = 1 - 24)

Table 5-2
T1/FT1 Interface Module Remote Control Commands (Continued)

Remote Command:	Result:
INTF:T1_FT1:RS232:CHAN_RATE?	Requests the currently selected transmit and receive channel rate
INTF:T1_FT1:RS232? INTF:T1_FT1:RS232 (xxx)	Requests the current configuration of the RS232 port Configures the RS232 port (xxx = DATALINK or CHANNEL)
INTF:T1_FT1:IDLE:PATTERN? INTF:T1_FT1:IDLE:PATTERN (xxx)	Requests the current idle pattern Sets the idle code (xxx = a 3-8 bit string of 1's or 0's)

5.9 FIREBERD 4000 SELF-LOOP TEST

The T1/FT1 Data Interface includes a relay that is activated by the **SELF LOOP** switch on the FIREBERD front panel. Pressing the **SELF LOOP** switch loops the TX OUTPUT to RX INPUT. This provides a quick verification of the FIREBERD mainframe and interface. User connections do not need to be removed during the test, since complete isolation is provided by the relay when testing in the Self-Loop mode.

SECTION 6
FIREBERD 4000 APPLICATIONS

6.1 INTRODUCTION

This section shows how the T1/FT1 Interface Module can be used with the FIREBERD 4000 in a variety of test scenarios. Test and instrument set-ups are provided for:

1. End-to-End Fractional T1 Testing
2. CSU Loopback Testing
3. Installing and Troubleshooting Customer Premise Equipment
4. T1/FT1 Drop and Insert

The procedures in this section assume that you possess a working knowledge of the T1/FT1 Interface Module and the FIREBERD 4000. If you are unfamiliar with the instruments, please refer to Section 5, Installation and Operation.

6.2 END-TO-END FRACTIONAL T1 TESTING

Figure 6-1 shows two FIREBERDs testing the performance of a Fractional T1 circuit end-to-end. End-to-end testing with the FIREBERD and T1/FT1 Interface enables you to evaluate and verify the end-to-end performance of the Fractional T1 service. This procedure requires two FIREBERDs. Both sides of the span are tested with a test pattern being transmitted from both ends of the span.

Table 6-1 contains the procedures to verify the performance of a 384 kb/s (6 x 64 kb/s) Fractional T1 circuit where channels 1 - 6 are used for data transmission.

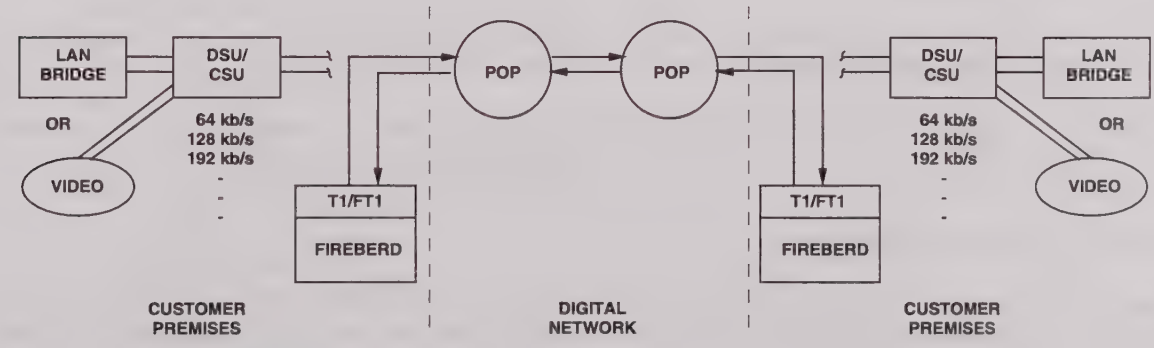

Figure 6-1
End-To-End Fractional T1 Testing

Table 6-1
End-To-End Fractional T1 Test Set-Up

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the designated rear-panel slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 4000. **RESULT:** The SETUP display shows the unit's current configuration. If the FIREBERD 4000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Press the **SETUP CATEGORY** switch to select the INTERFACE category.
4.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the INTERFACE SETUP menu as follows: **NOTE:** Unless otherwise indicated, press the right half of the **SETUP SELECT** switch once between selections. Select: 1. T1/FT1 to select the T1/FT1 Interface Module. 2. FRAMING to select framing (example: ESF). 3. CODING to select coding (example B8ZS). 4. INPUT to TERM. 5. LBO (Line Build Out) as required (0 dB, -7.5 dB, or -15 dB). 6. MODE to FRACT1. 7. Press the CHAN # softkey to scroll through the channel numbers. Press the TX and RX softkey to select channels 1 - 6. Press the 56/64 softkey to select either Nx56 or Nx64 channel data rate. 8. Set the IDLE code. Use the CHAN # softkey to select the channels. Position the cursor with the left and right cursor keys and use the SET0 and SET1 softkeys to enter the idle code. Common idle codes: 0111 1111 or 1111 1111. 9. ERRINS to OFF.
5.	Press the **SETUP CATEGORY** switch to select the GENERATOR CLOCK category and select INTF to derive the transmit clock from the network.
6.	Press the **SETUP CATEGORY** switch to select the PATTERN category. Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the PATTERN SETUP menu to QRSS.

6.3 CSU LOOPBACK TESTING

Figure 6-2 shows the FIREBERD 4000 performing a CSU loopback test. With the FIREBERD and T1/FT1 Interface Module loopback tests can be performed using any in-band or out-of-band (ESF Data Link) loop codes. The instrument terminates the near-end of the T1 network and transmits data to and receives data from the far-end CSU. The FIREBERD sends a loop-up code to the far-end CSU; the far end CSU goes into loopback toward the T1 network and the FIREBERD. By analyzing the received data for errors, the FIREBERD analyzes the performance of the network up to and including the far-end CSU.

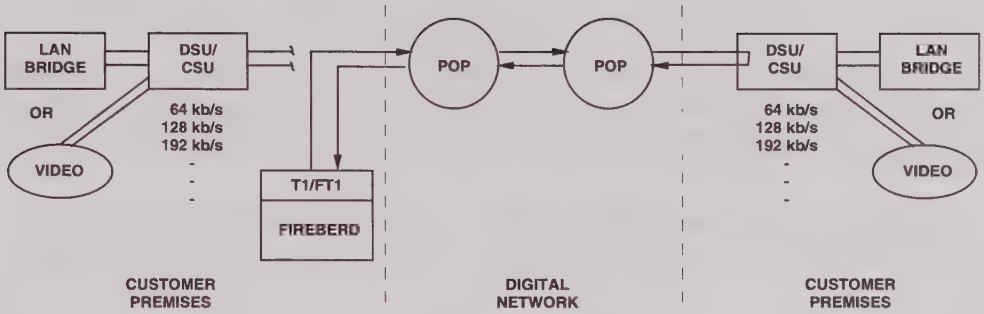

Figure 6-2
CSU Loopback Testing

Table 6-2 provides the procedures to configure the FIREBERD for an ESF CSU Payload Loopback test.

Table 6-2
CSU Loopback Test Set-Up

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the designated rear-panel slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 4000. **RESULT:** The SETUP display shows the unit's current configuration. If the FIREBERD 4000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Press the **SETUP CATEGORY** switch to select the INTERFACE category.
4.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the INTERFACE SETUP menu as follows: **NOTE:** Unless otherwise indicated, press the right half of the **SETUP SELECT** switch once between selections. Select: 1. T1/FT1 to select the T1/FT1 Interface Module. 2. Framing to select ESF framing. 3. Coding to select B8ZS coding. 4. INPUT to TERM. 5. LBO (Line Build Out) as required (0 dB, -7.5 dB, or -15 dB). 6. MODE to FULLT1. 7. ERRINS to OFF. 8. LOOP TYPE to DL-PLB to select ESF Payload Loopback codes.
5.	Press the **SETUP CATEGORY** switch to select the PATTERN category.
6.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the PATTERN SETUP menu to QRSS.
7.	Press the front panel **LOOP UP** switch to loop up the far-end CSU. When the test is complete press the front panel **LOOP DOWN** switch to loop down the CSU.

6.4 INSTALLING AND TROUBLESHOOTING CUSTOMER PREMISE EQUIPMENT

Figure 6-3 shows two FIREBERD 4000s accessing both the DTE and T1 network side of the CPE. FIREBERD #1 is equipped with a V.35 Data Interface and FIREBERD #2 is equipped with a T1/FT1 Interface Module. By accessing both sides of the CPE, the FIREBERD can test for proper T1 timing and signal level using slips and level measurement while performing BERT analysis on the designated bandwidth.

The procedures in Tables 6-3 and 6-4 provide the configuration to test a fractional T1 DSU/CSU as a stand-alone piece of equipment. In this application 256 kb/s (4 x 64 kb/s) bit error analysis is performed on 4 non-contiguous channels.

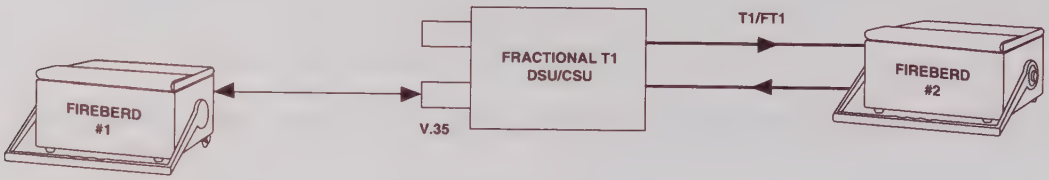

Figure 6-3
Installing and Troubleshooting CPE

Table 6-3 describes the set-up procedures for FIREBERD #1.

Table 6-3
FIREBERD #1

Step:	Activity:
1.	With the power to the unit turned off, insert the V.35 Interface Module in the designated rear-panel slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 4000. **RESULT:** The SETUP display shows the unit's current configuration. If the FIREBERD 4000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Press the **SETUP CATEGORY** switch to select the INTERFACE category.
4.	The V.35 Interface is not controllable via the FIREBERD 4000 front panel. Select V.35 from the INTERFACE menu, to configure the interface use the switches on the interface as follows: Standard Set-Up: 1. Set TRANSMIT CLOCK INVERT switch to NORMAL. 2. Set RECEIVE CLOCK INVERT switch to NORMAL. 3. Set TIMING MODE switch to 306.
5.	Press the **SETUP CATEGORY** switch to select the GENERATOR CLOCK category.
6.	Set the GENERATOR CLOCK to INTF to receive the clock form the DCE.
7.	Press the **SETUP CATEGORY** switch to select the PATTERN category.
8.	Select the test data pattern using the PATTERN softkeys.

Table 6-4
FIREBERD #2

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the empty rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 4000. **RESULT:** The SETUP display shows the unit's current configuration. If the FIREBERD 4000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Press the **SETUP CATEGORY** switch to select the INTERFACE category.
4.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the INTERFACE SETUP menu as follows: **NOTE:** Unless otherwise indicated, press the right half of the **SETUP SELECT** switch once between selections. Select: 1. T1/FT1 to select the T1/FT1 Interface Module. 2. Framing to select ESF framing. 3. Coding to select AMI coding. 4. INPUT to TERM. 5. LBO (Line Build Out) as required (0 dB, -7.5 dB, or -15 dB). 6. MODE to FRACT1. 7. Press the CHAN # softkey to scroll through the channel numbers. Press the TX and RX softkeys to select channels 1, 3, 5, and 7. Press the 56/64 softkey to select either Nx56 or Nx64 channel data rate. 8. Set the IDLE code. Use the CHAN # softkey to select the channels. Position the cursor with the left and right cursor keys and use the SET0 and SET1 softkeys to enter the idle code. 9. ERRINS to OFF.
5.	Press the **SETUP CATEGORY** switch to select the GENERATOR CLOCK category.
6.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the GENERATOR CLOCK SETUP menu to INTF to derive the transmit clock from the DCE.
7.	Press the **SETUP CATEGORY** switch to select the PATTERN category. Use the **SETUP SELECT** switch and the softkeys below the SETUP display to set PATTERN to QRSS.

6.5 T1/FT1 DROP AND INSERT

An end user has a 6x64 kb/s FT1 circuit, with four channels (1-4) used for video teleconferencing and two channels (5-6) used for PBX trunks. Because customers are only experiencing problems with the video circuit, the test objective is to troubleshoot the problem without taking the PBX trunks out of service.

In this application, a FIREBERD can perform a 256 kb/s (4x64 kb/s) BERT test without disrupting live traffic on the remaining channels (Figure 6-4). On the line side of the FT1 multiplexer, the FIREBERD equipped with a T1/FT1 Interface Module inserts a test pattern on channels 1-4; on the drop side of the FT1 multiplexer, the FIREBERD equipped with a data communications interface actually performs the BERT test. During this test, traffic on channels 5 and 6 passes unaltered.

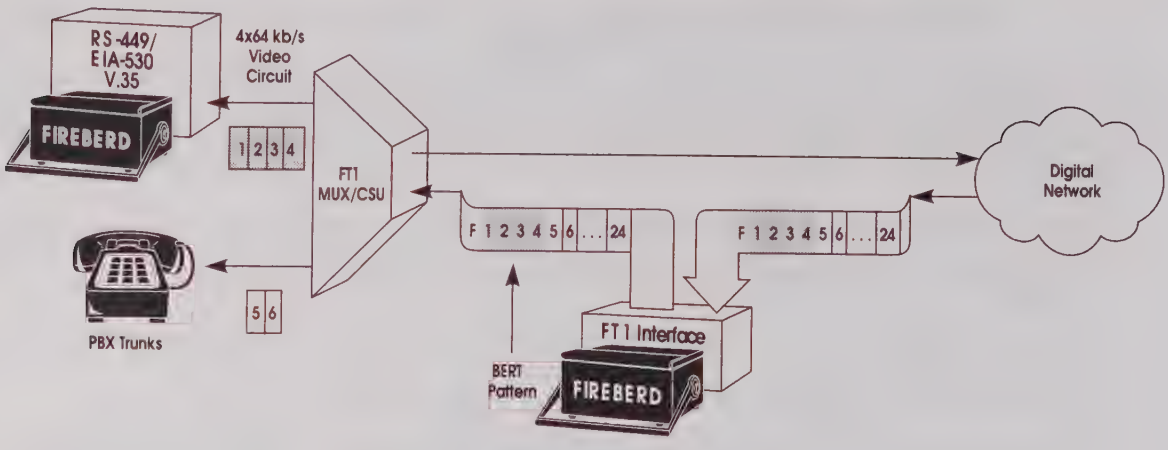

Figure 6-4
FT1 Drop and Insert Testing

Table 6-5 lists the set-up procedures for the FIREBERD on the drop side of the FT1 multiplexer (a V.35 interface is assumed); Table 6-6 lists the set-up procedures for the FIREBERD on the line side of the FT1 multiplexer (equipped with the T1/FT1 Interface Module). In this application, 256 kb/s (4 x 64 kb/s) bit error analysis is performed on four contiguous channels.

Table 6-5
FT1 Drop and Insert Testing (FIREBERD 4000 #1)

Step:	Activity:
1.	With the power to the unit turned off, insert the V.35 Interface in the designated rear-panel slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 4000. **RESULT:** The SETUP display shows the unit's current configuration. If the FIREBERD 4000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Press the **SETUP CATEGORY** switch to select the INTERFACE category.
4.	The V.35 Data Interface is not controllable via the FIREBERD 4000 front panel. Select V.35 from the INTERFACE menu, to configure the interface use the switches on the interface as follows: Standard Set-Up: 1. Set TRANSMIT CLOCK INVERT switch to NORMAL. 2. Set RECEIVE CLOCK INVERT switch to NORMAL. 3. Set TIMING MODE switch to 306.
5.	Press the **SETUP CATEGORY** switch to select the GENERATOR CLOCK category.
6.	Set the GENERATOR CLOCK to INTF to receive the clock form the DCE.
7.	Press the **SETUP CATEGORY** switch to select the PATTERN category.
8.	Select the test data pattern using the PATTERN softkeys.

Table 6-6
Drop and Insert Testing (FIREBERD 4000 #2)

Step:	Activity:
1.	With the power to the unit turned off, insert the T1/FT1 Interface Module in the empty rear-panel interface slot.
2.	Press the **POWER** switch to apply power to the FIREBERD 4000. **RESULT:** The SETUP display shows the unit's current configuration. If the FIREBERD 4000 is in Self-Loop mode after power-up, press the **SELF LOOP** switch to extinguish its LED.
3.	Press the **SETUP CATEGORY** switch to select the INTERFACE category.
4.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the INTERFACE SETUP menu as follows: **NOTE:** Unless otherwise indicated, press the right half of the **SETUP SELECT** switch once between selections. Select: 1. T1/FT1 to select the T1/FT1 Data Interface. 2. Framing to select ESF framing. 3. Coding to select AMI coding. 4. INPUT to TERM. 5. LBO (Line Build Out) as required (0 dB, -7.5 dB, or -15 dB). 6. MODE to FT1INS. 7. Press the CHAN # softkey to scroll through the channel numbers. Press the TX and RX softkeys to select channels 1, 2, 3, and 4. Press the 56/64 softkey to select either Nx56 or Nx64 channel data rate. 8. Set the IDLE code. Use the CHAN # softkey to select the channels. Position the cursor with the left and right cursor keys and use the SET0 and SET1 softkeys to enter the idle code. 9. ERRINS to OFF.
5.	Press the **SETUP CATEGORY** switch to select the GENERATOR CLOCK category.
6.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the GENERATOR CLOCK SETUP menu to INTF to derive the transmit clock from the DCE.
7.	Press the **SETUP CATEGORY** switch to select the PATTERN category. Use the **SETUP SELECT** switch and the softkeys below the SETUP display to set PATTERN to QRSS.

SECTION 7
SPECIFICATIONS

7.1 INTRODUCTION

This section contains the specifications for the T1/FT1 Interface.

Operating Modes

- T1 Unframed
- T1 Framed (D4, ESF, SLC-96)
- Fractional T1:
  - Nx64 kb/s or Nx56 kb/s (N=1 to 24)
  - Contiguous or Noncontiguous Channel Selections
  - User-Selectable 8-bit Idle Code
- Fractional T1 Drop and Insert
- Voice & Signaling Bit Transmit/Receive
- T1 Line Loopback
- T1 Test Loopback
- ESF Data Link
- RS-232 Transmit/Receive
- T1.403 PRM (FIREBERD 6000 only)

Receive Input

- Input Frequency: 1544000 b/s ± 500 b/s minimum tolerance
- Input Impedance:
  - TERM: 100 ohms + 5%
  - DSX-MON: 100 ohms + 5%
  - BRIDGE: 1000 ohms minimum
- Operating Range:
  - TERM: +6 dBdsx to -35 dBdsx cable attenuation
  - DSX-MON: -10 dBdsx to -30 dBdsx resistive attenuation

T1 Reference Input

- Input Frequency: 154000 b/s ± 500 b/s minimum tolerance
- Input Impedance:
  - TERM: 100 ohms + -5% ohms
  - BRIDGE: 1000 ohms minimum

Output Specifications

- Output Line Build Out:
- Selectable 0 dB, -7.5 dB, -15 dB with + -1 dB attenuation at 772 kHz
- Pulse Shape
- Meets Bell Publication CB113, CB119, CB143, and AT&T PUB 41451, AT&T PUB 62411 and AT&T PUB 62508
- Line codes: AMI and B8ZS

Interface

- Logic Errors: Single or rate
- BPVs: Single or rate
- Logic and BPVs: Single or rate
- Frame: Single or consecutive (consecutive range: 2-4)
- Error insertion on F^t bits (D4 or SLC-96 Framing) or FPS bits (for ESF Framing)
- Error Insertion Rates: 1E-9 to 9E-3 FIREBERD 6000
  1E-6 FIREBERD 4000

Loop Code Generation

- CSU (Loop-up code: 10000; Loop-down code: 100)
- Facility Loop Code 1: (Loop-up code: 1100; Loop-down code: 11100)
- Facility Loop Code 2: (Loop-up code: 11000; Loop-down code: 11100)
- DL-LLB (Data Link-Line Loopback): per ANSI Standard T1.403-1989
- DL-PLB (Data Link-Payload Loopback): per ANSI Standard T1.403-1989
- Programmable Loop Codes: 3 to 8 bit repeating loop-up and loop-down codes

Indicators

- Code: B8ZS Detect
- ALM1: Yellow Alarm
- ALM2: Excess Zeros
- ALM3: Alarm Indication Signal (FIREBERD 4000 only)

Alarm Criteria

- Yellow Alarm
- D4 or SLC Bit 2 is 0 for 255 consecutive bits
- ESF 256 bit + 16 bits of a repetitive "1111111100000000" pattern received in the 4 kb/s data link
- Excess Zeros:

  16 or more consecutive zeros
  AIS (All Ones):
  Unframed All Ones
  Per AT&T PUB 62411 and Bell Publication TR-TSY-000191

Measurements

- Frequency Accuracy: + 5ppm (+1 ppm optional)
- Resolution: 1 Hz

Level

- Peak-to-peak: 60 mV to 12.0 V
- Positive and negative base to peak: 30 mV to 6.0 V
- Positive and negative base to peak: +6 dBdsx to -40 dBdsx
- Resolution: 0.1 dB
- Accuracy ±10%

Simplex Current

- Range: 0 mA to 200 mA
- Resolution: 1 mA
- Accuracy: ±5%
- Voltage Drop: 7.3 V ±5% at 60 mA

Timing Slips

- Resolution: 1 bit slip
- Range: ±65536 bit slips

Wander

- Resolution: 1 UI
- Accuracy: 1 UI

Channel Analysis

- Byte Decoder
- ABCD Signaling Bit Display

Connectors

- T1 Receive Input: Bantam
- T1 Transmit Output: Bantam
- T1 Reference Input: Bantam
- RS-232 Port: RJ-45 (Configuration: DCE, Rates: 4 kb/s, 64 kb/s and 56 kb/s synchronous)
- Handset Port: RJ-8 (Companding: μ-law)

SECTION 8
MAINTENANCE AND SERVICE

8.1 INTRODUCTION

This section contains information on maintenance and service for the T1/FT1 Data Interface. It also describes TTC's warranty policies and repair procedures.

8.2 MAINTENANCE

8.2.1 In Case of Difficulty

If the unit fails to operate and no front panel indicators illuminate, check the following:

- AC power cord and AC power supply
- AC fuse and fuse rating
- Interface properly inserted

If some indicators illuminate but the unit fails to operate, verify that the interface in use is the correct type and is properly inserted (turn off power before inserting or removing interface). Check the interface cables and connections to the FIREBERD. Try substituting another interface if one is available.

Follow the self-test procedures in the FIREBERD Reference Manual as an aid in localizing the problem. If the unit continues to be inoperative, refer to the following sections for service information or call the TTC Customer Service Department at (800) 638-2049 for applications assistance.

NOTE: Verify that the interface clock source is connected before attempting self-test.

8.3 SERVICE

8.3.1 Warranty Policy

All equipment manufactured by Telecommunication Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Liability under this warranty extends only to the replacement value of the equipment. The warranty is void if:

1. Equipment has been altered or repaired without specific authorization from TTC.
2. Equipment is installed or operated other than in accordance with instructions contained in TTC literature and manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

8.3.2 In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipping prepaid. The equipment should be packed and shipped in accordance with the instructions in Section 8.3.4 of this manual. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Repair Department. The RA number should then appear on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it will be tested to ensure it meets applicable specifications and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report furnished with the returned equipment.

8.3.3 Out-Of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty.

However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty repair charge.

The customer will be billed for parts plus standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started, and a hard copy of the purchase order must be received by TTC before the repaired equipment may be shipped to the customer. A description of the labor and materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

8.3.4 Equipment Return Instructions

The customer should attach a tag to all equipment returned for repair that includes the following information:

1. Owner's name and address.
2. A list of equipment being returned and the applicable serial number(s).
3. A detailed description of the problem or service requested.
4. The name and telephone number of the person to contact regarding questions about the repair.
5. The Return Authorization (RA) number.

If possible, the customer should return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC issued RA number on the outside of the package and ship it prepaid and insured to TTC.

APPENDIX A
FACTORY DEFAULT SETTINGS

A.1 INTRODUCTION

Table A-1 lists the factory default settings for the T1/FT1 Interface Module.

Table A-1
Factory Default Settings

Item:	Factory Default:
MODE	FULL T1
FRAME	ESF
CODE	AMI
INPUT	TERM
LBO	0 dB
REFT1	BRIDGE
FRACT1	
CH01 - CH24	CH01
Tx	01x64
Rx	01x64
VOICE	
Tx	01
Rx	01
ABCD	0000
RS232	
Tx	01
Rx	01
ERRINS	
LOGIC	OFF
RATE	1E-6
IDLE	01111111
CH01	IDL
LOOP TYPE	CSU
RCVBYT CHANNEL	1

APPENDIX B
FIREBERD 4000 Rev. 4
REMOTE CONTROL COMMANDS

B.1 FIREBERD 4000 Remote control commands

Remote control commands for FIREBERD 4000 mainframes equipped with Rev. 4 software are listed in Table B-1. These remote control commands comply with IEEE-488-1987 specifications.

Table B-1
T1/FT1 Interface Module Remote Control Commands

Remote Command:	Result:
INT SET T1/FT1 FRAME? INT SET T1/FT1 FRAME (xxx)	Requests the current framing selection Sets the framing (xxx = OFF, ESF, D4, SLC)
INT SET T1/FT1 CODE? INT SET T1/FT1 CODE (xxx)	Requests the current coding selection Sets the coding (xxx = AMI, B8ZS)
INT SET T1/FT1 INPUT? INT SET T1/FT1 INPUT (xxx)	Requests the current input impedance Sets the input impedance (xxx = TERM, BRIDGE, DSXMON)
INT SET T1/FT1 LBO? INT SET T1/FT1 LBO (xxx)	Requests the current Line Build Out Sets the Line Build Out (xxx = 0dB, -7.5dB, -15dB)
INT SET T1/FT1 REF T1? INT SET T1/FT1 REF T1 (xxx)	Requests the current T1 reference input Sets the reference input (xxx = TERM, BRIDGE)
INT SET T1/FT1 MODE? INT SET T1/FT1 MODE (xxx)	Requests the current mode of operation Sets the mode of operation (xxx = T1, FT1, VOICE, TLB, LLB, ESFDL, RS232)
INT SET T1/FT1 ERRINS? INT SET T1/FT1 ERRINS (xxx)	Requests the current type of error insertion Sets the error insertion (xxx = OFF, BPV, LOGIC, L+BPV, SINGLE, 1E-6)
INT SET T1/FT1 IDLE SCAN?	Requests which channels contain the idle code.
INT SET T1/FT1 IDLE CODE? INT SET T1/FT1 IDLE CODE bbbbbbbb	Requests the current idle code Sets the idle code (bbbbbbbb = up to 8 bits of 1's and 0's)
INT SET T1/FT1 LOOPTYPE? INT SET T1/FT1 LOOPTYPE (xxx)	Requests the current loop code selected Sets the loop code (xxx = CSU, FAC1, FAC2, DL-LLB, DL-PLB, PRGM)
INT SET T1/FT1 PRG UP? INT SET T1/FT1 PRG UP bbbbbbbb	Requests the current programmed loop-up code Programs the loop-up code (bbbbbbbb = up to 8 bits of 1's and 0's)
INT SET T1/FT1 PRG DOWN? INT SET T1/FT1 PGRM bbbbbbbb	Requests the current programmed loop-down code Programs the loop-down code (bbbbbbbb = up to 8 bits of 1's and 0's)

Table B-1
T1/FT1 Interface Module Remote Control Commands (Continued)

Remote Command:	Result:
INT SET T1/FT1 RCVBYT? INT SET T1/FT1 RCVBYT (xx)	Requests the currently displayed channel Sets a channel (xx = 1 - 24)
INT SET T1/FT1 FRACT1 CHAN NN (xxx)	Sets the status (yy = OFF, TX, RX, BOTH) of the selected channel (xx = 1 - 24)
INT SET T1/FT1 FRACT1 AUTO	Activates the idle scan and sets TX and RX to non-idle channels
INT SET T1/FT1 FRACT1 CLRALL	Clears all channel selections
INT SET T1/FT1 FRACT1 RATE? INT SET T1/FT1 FRACT1 RATE (xx)	Requests the currently selected channel bandwidth Sets the channel bandwidth used for testing (xx = 64, 56)
INT SET T1/FT1 VOICE TXCHAN? INT SET T1/FT1 VOICE TXCHAN (xx)	Requests the current voice transmit channel Sets the voice transmit channel (xx = 1 - 24)
INT SET T1/FT1 VOICE RXCHAN? INT SET T1/FT1 VOICE RXCHAN (xx)	Requests the current voice receive channel Sets the voice receive channel (yy = 1 - 24)
INT SET T1/FT1 VOICE ABCD? INT SET T1/FT1 VOICE ABCD (xxxx)	Requests the current logic state of the ABCD signaling bits of the selected transmit channel Programs the logic state of the ABCD signaling bits (xxxx = string of 1's and 0's, OFF)
INT SET T1/FT1 RS232 TXCHAN? INT SET T1/FT1 RS232 TXCHAN (xx)	Requests the currently selected RS232 transmit channel Sets the RS232 transmit channel (xx = 1 - 24)
INT SET T1/FT1 RS232 RXCHAN? INT SET T1/FT1 RS232 RXCHAN (xx)	Requests the currently selected RS232 receive channels Sets the RS232 receive channel (yy = 1 - 24)

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